INVOLVEMENT OF CIVIL SOCIETY ACTORS IN NANOTECHNOLOGY: CREATING PRODUCTIVE SPACES FOR INTERACTION

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There is a crack in everything
That's how the light gets in

Leonard Cohen

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Chapter 1 Nanotechnology as a topic for deliberation

Introduction

Civil society actors, both individual citizens and civil society organizations, remain outside the development trajectories of newly emerging science and technology (NEST).[1] They are confronted with new technology options only when these are entering the market, and later, when unintended side effects are experienced. This division of roles and responsibilities between technology developers and civil society actors is now problematized, particularly by government agencies, who call for more inclusive governance of emerging technologies (Commission of the European Communities, 2001). Civil society actors are invited to participate as new dialogue partner already in the early stages of the development. This is particularly visible in the development of newly emerging nanosciences and nanotechnologies,[2] where so-called upstream public engagement is tried out in a number of countries, and in different ways, up to fully fledged societal dialogues about nanotechnology (Wilsdon & Willis, 2004; Pidgeon, 2008).

The starting point of this thesis is the occurrence of early involvement of civil society actors in nanotechnology, tracing what is happening and evaluating it. It is part of a larger effort to create anticipatory governance of nanotechnology. Instead of waiting for societal impacts to become visible in society, government agencies and some technology developers now try to anticipate possible societal impacts, with the aim to make better, that is, more informed, decisions about the further

[1] The acronym NEST has been used for a small funding programme within the European Commission's 6th Framework Programme, standing for 'New and Emerging Science and Technology'. Swierstra & Rip (2007) adopted the acronym and the full version in their often cited article on nano-ethics, coining the term NEST-ethics (Swierstra & Rip, 2007, p. 4). As I have done in this thesis, they wanted to draw attention to the phenomenon of newly emerging science and technology, with its halo of expectations leading to anticipatory discussion. When they realized that the use of 'and' between 'new' and 'emerging' could lead to misunderstandings, as if there were two different categories, 'new' and 'emerging', they started using '&' rather than 'and', and recently, the more pointed phrasing 'newly emerging'. It is this phrasing that I will use. Nanotechnology overall is an instance of NEST, even if some R&D and product development trajectories, such as the miniaturization trajectory in micro-nano-electronics, have now become established.

[2] The study, control and manipulation of matter on the atomic and molecular scale. Henceforth, newly emerging nanosciences and nanotechnologies will be captured under the umbrella term 'newly emerging nanotechnology'.

development of nanotechnology in the here and now.[3] Civil society actors are involved because they are expected to be knowledgeable in giving voice to concerns, needs and wishes of society (European Commission, 2001). The idea is that nanotechnology developers can become more responsive to societal needs and issues, and include these in their decision making processes (European Commission, 2004).

Early public involvement is to be welcomed because of the opportunities it provides to bring in new perspectives, experiences and dilemmas into deliberation processes. However, more can be achieved. Rather than just calling for participation (for the sake of participation), the challenges of having newly emerging science and technology as a topic for deliberation, that is, how to address the combination of promises and uncertainty about actual outcomes, have to be taken into account more explicitly. This now happens, to some extent, but there is a division of labour between technology developers and civil society actors which creates limitations to articulation and learning. Technology developers are expected to provide factual knowledge on nanotechnology, and civil society actors are expected to recognize and articulate societal issues and values. Developers of nanotechnology can listen, and eventually decide to consider these issues in their decision making processes – or not. Technology developers are not expected to share, and discuss their activities. Such a division of labour simplifies and underestimates socio-technical complexity. It assumes that nanotechnology, as well as societal issues are given, while in the early stages, newly emerging science and technology is still indeterminate. Promises are voiced by technology developers, for example about cheaper healthcare or better food, but nobody can know what forms the technology will take, how it will materialize in society and what the societal impacts might be (Barben et al., 2007; Robinson, 2010). What kind of societal issues might emerge depends on what kind of considerations, decisions and actions are made by actors with roles and mandates to develop and embed NEST, like scientists, industrialists and policy makers. Societal issues are thus not out there, but co-evolve with the development of nanotechnology. What is at stake, for whom, and what kind of decisions are to be made, must all be inquired into and further articulated.

The aim of this thesis is to examine what could be good spaces where better interaction between nanotechnology developers and civil society actors can be realized. That is, spaces where both technology developers and civil society share and discuss their activities, and inquire into how

[3] In addition to stimulating the involvement of civil society, there are other examples of anticipatory governance attempts to better manage newly emerging nanotechnology. These are the funding and institutionalization of ELSA research as such and within R&D consortia (for example TA flagship in the Dutch R&D consortia NanoNed and NanoNext), voluntary Codes of Conduct for industry, and the formulation and attempt at implementation of an EU Code of Conduct for responsible nanosciences research (Commission of the European Communities, 2008).

these are entangled, thereby discovering emerging societal issues occasioned by the development of newly emerging nanotechnology. In addition to creating good spaces for interaction, there must also be changes in broader institutional and cultural contexts in which the interactions take place. Universities and firms must offer openings for these types of interaction to occur, and allow for the uptake of the results.

This topic will be studied in two ways. First, empirically, by analysing spaces for interaction where actors experimented with a new division of labour. Second, by developing ideas, building on the work of political philosophers John Dewey and Hannah Arendt, about good spaces for interaction, and the broader context. These political-philosophical insights are used to analyse the empirical cases.

This introductory chapter will discuss the present situation of upstream public engagement and its limitations. Therefore, I will draw on empirical insights provided by the scholarly fields studying Public Engagement and Science Communication. From the beginning I will also locate spaces for interaction where NEST can be a topic for deliberation in broader institutional and cultural contexts, as this is the way to understand what is happening and articulate what could and should happen to have more societal learning and articulation processes. I will introduce the idea and practice of the public sphere in society as a background requirement to have more productive deliberations on nanotechnology and its emerging societal issues. A vital public sphere, where members of society can engage in extended deliberations (reaching across space and time) through a variety of media by bringing up ideas and opinions for exchange and discussion, in principle allows for continuous inquiry into and articulation of what is happening in society. There is as yet no tradition to include NEST as a topic for deliberation in the public sphere. And actually, this will not be easy, given the combination of promises and uncertainty. The current discourse and experimentation of upstream public engagement however can be seen as a bottom up experimentation to extend the traditional public sphere in our societies. I will explore the challenges to include deliberation of NEST in the public sphere. On the basis of these discussions, I can outline what I will have to do to address the topic of this thesis, good spaces for interaction with civil society about newly emerging nanotechnology,[4] which will lead to research questions and a research design and methodology.

[4] While the importance of this topic is based on what is happening in the world, the focus on nanotechnology and on the role of civil society actors was pre-given because the thesis project is part of the TA Programme of the Dutch R&D consortium NanoNed. See Rip & Van Lente (2013) for an overview and evaluation of the TA programme.

Upstream public engagement

Upstream public engagement with newly emerging science and technology has been on the policy agenda for some time. There are now concrete experiments being undertaken,[5] initiated also by technology development actors because of their concern to 'do it right from the beginning' (Krupp & Holliday, 2005). A further step is the recent policy initiative to create 'responsible research and innovation' (Von Schomberg, 2012). Creating responsible research and innovation in newly emerging nanotechnology is now seen as a matter of concern for all: the policymaking world explicitly encourages nanotechnology developers, such as scientists and industrialists, to become more responsive to societal issues and needs by engaging in early stage interaction with civil society on the development and possible societal impacts of nanotechnology and to take up the issues that are articulated in this interaction in their decision-making processes. Phrases such as 'voices of civil society must be heard' and 'nanotechnology developers should engage with civil society' testify to this. Through individual citizens and civil society organizations, civil society is expected to become involved, actively participate and identify societal issues.

There is a tension in referring to civil society this way because the notion of civil society suggests that it encompasses every citizen, including the scientists, industrialists and policymakers who are supposed to be interacting with civil society. I will not resolve this conundrum, and actually follow the usage of the notion of civil society that is now visible in upstream engagement: civil society as a collective in its own right, distinct from actors who see themselves responsible for the development and embedding of nanotechnology.[6]

This common usage builds upon, and reinforces the division of labour between developers of NEST and civil society. While there are societal learning processes with regard to handling NEST in society, in which lessons are drawn from the governance of other emerging technologies in the past, like

[5] These concrete experiments range from one-day events in which nanoscientists and citizens meet (e.g. CSIRO Nanotechnology Australia, (Katz et al., 2009); to Constructive Technology Assessment workshops as part of the Dutch R&D consortium NanoNed (Parandian, 2012; Robinson, 2010); to a sequence of events (for example Nanojury UK (2005) (Pidgeon & Rogers-Hayden, 2007), Citizens Jury Les Nanos et Nous France (2007) http://espaceprojets.iledefrance.fr/jahia/Jahia/NanoCitoyens/site/projets; to large-scale societal dialogues in France and the Netherlands (Doridot, 2012; Hanssen et al. 2011; Krabbenborg,2012).

[6] One might speak of different roles, where the technology development actor is outside civil society when at work, but a citizen like others when at home and active in the neighbourhood. This only touches the surface of the problem. In Section 1.2. I will come back to the phenomenon of the public sphere and argue that it offers an entrance point to productively address the a priori division of roles and responsibilities between technology developers and civil society.

nuclear energy and biotechnology, the learning is limited because the division of labour is taken for granted, even in well-intentioned engagement exercises in more inclusive governance of nanotechnology. I offer three examples where this is visible. These examples are also useful to articulate ways to do better.

First, there is a concern that nanotechnology, with its potential to create novel and unpredictable impacts on society, will reach the same impasse as genetically modified organisms (GMOs) since the 1990s, with public resistance and a public backlash against the development and introduction of GMOs (Joly & Kaufmann, 2008). This serves as an argument, definitely for government agencies, to do things differently and better in the case of nanotechnology (Parliamentary Documents, 2006).[7] The public backlash against GMOs is often framed by government agencies as a problem of communication and information: the communication started too late and there was a lack of adequate information for civil society to become properly informed. Thus, with regard to nanotechnology, we need to do better and involve civil society upstream. As the Director of the European Research Area, Octavi Quintana, phrased the issue of stimulating more communication and information:

> *'We evidenced that we need to involve civil society very upstream to avoid misunderstanding and difficulties afterwards.'* (European Commission, 2011).

Second, the risk issues that dominated the discussion on GMOs are now, with nanotechnology, seen by government and also some companies as only one element of the broader ethical and societal issues that should be taken into account. When the Dutch government formulated their idea of a dialogue with citizens in their policy memorandum on nanotechnology, they were explicit about it:

> *'The Cabinet wants to work towards a societal basis for nanotechnologies by engaging in dialogue with citizens. If there is one thing that we have learned from the debate on genetically modified organisms, it is that societal acceptance of technologies that have ethical questions alongside risks only comes*

[7] There was earlier societal debate with regard to recombinant DNA in the 1970s. Investment in biotechnology in the 1980s was accompanied by public debates (Rip & Talma, 1998), which increased during the 1990s when GM food was introduced to the market. People were hesitant to buy GM products and environmental organizations and consumer groups were concerned about potential harm to human health, consumer freedom and the power of industry (with dominant companies such as Monsanto). As a response to the social contestation, government agencies and industry wanted to involve representatives of civil society. By the early 2000s, government agencies in the Netherlands and the UK had initiated large-scale societal debates. The assumption was that informed dialogue would lead to societal acceptance – which, however, did not happen.

about when these questions are taken seriously at an early stage.' (Parliamentary Documents, 2006) (translation by author)

This broader perspective is also visible in how industry, in particular the chemical industry, derived lessons from the process of the societal embedding of GMOs and developed strategies for more interaction with civil society. As chemical company Bayer states on its website:

> *'We believe societal acceptance is essential for technological innovation. Accordingly, the public sector together with industry has to ensure society's awareness of the benefits generated by nanotechnology. Bayer supports platforms that promote dialogue about the benefits as well as the concerns on risks of nanotechnology with civil society and the general public in a climate of openness.'*[8]

In practice, however, it is very easy to fall back on risk aspects because these are more tangible. This is illustrated in my third case study, of the Dutch Societal Dialogue on Nanotechnology.

In a third example – the funding of so-called ELSA research (Ethical, Legal and Societal Aspects), as such or as part of Research & Development consortia, sometimes in the form of dedicated centres – the expectation of the scientists and technology developers involved is that such social science research should tell them what the public or society 'out there' think about the newly emerging technology.[9]

ELSA studies are an example of the present anticipatory approach to newly emerging technologies. In earlier cases, specifically nuclear energy and biotechnology, deliberations between civil society actors (individual citizens and civil society organizations) and actors with responsibilities and mandates to develop new science and technology, such as scientists and industrialists, were organized as a response to public contestation and resistance (for example, protest against nuclear power plants,

[8] www.baycareonline.com/nanomaterial_stewardship_EN.asp (last visited 16 June 2012).

[9] The institutionalization of ELSA research in R&D consortia started in the context of the US Human Genome project in the 1990s, from 'where it subsequently spread to Canada, and Europe' (Zwart & Nelis, 2009), and is now part of recently established newly emerging science and technology programmes such as nanotechnology (ELSA research in the Netherlands was part of NanoNed (2006-2011) and now also part of the successor of NanoNed, Nanonext (2012-2016). The Norwegian Research Council's programmes also included ELSA components in their nanotechnology research (2008-2014). R&D consortia stimulating genomics research also included ELSA components (cf. Netherlands Genomics Initiative [2008-2012]) and the functional genomics (FUGE) (2002-2011) programme in Norway. For an evaluation of the recent situation see Rip (Rip, 2009).

consumers who refuse to buy GM food). In the development of nanotechnology, spaces for interaction are organized proactively (and by different actors such as Technology Assessment [TA] agents, government agencies and companies) at an early stage of the development. This observation implies a further background issue: how to address the essential indeterminacy of new nanotechnology. One effect has been an emphasis on the provision of information concerning what nanotechnology 'is'. The inverted commas are used here because nanotechnology is not yet fixed, even if one can say something about the science and list some early applications. When interacting with civil society this creates an ambiguity: the open-ended nature of indeterminate nanotechnology makes it difficult to deliberate upon it, but its reduction to what is more tangible, for example a few nano-enabled products (as Throne-Holst (2012) did for his focus groups), limits the scope of the discussion(Throne-Holst, 2012). There is literature on the issues of uncertainty, ambiguity and ignorance about actual developments and the potential societal issues, which together make up the indeterminacies (Stirling, 2007).[10]

[10] Drawing on Stirling (2007), uncertainty refers to those circumstances in the development of newly emerging technology where possible outcomes can be pictured, but there is a lack of information to assign probabilities. In the current process of development of nanotechnology, uncertainty is visible with regard to the potential hazards of manufactured nanoparticles (there is little equipment to detect and measure the occurrence of nanoparticles on the work floor, and, moreover, no one knows which particles to look for or what indicators there are for toxicity). Ambiguity refers to those circumstances where there is a possible outcome but its meaning is not clear, making discussion of its value difficult. This may lead to ambivalence, in which individuals and groups with different frames of reference attach different meanings to the same 'fact' or 'object'. For example, there are now consumer products such as washing machines, refrigerators, socks and deodorant that contain engineered nano-silver particles with an anti-bacterial function. There have been ambivalent responses to these new nanoproducts. Industrialists have emphasized the benefits (no more odours), while environmental and consumer organizations have raised concerns about environmental impacts and the limited added value of these products. Under the condition of ignorance, neither probabilities nor outcomes can be characterized: 'we do not know what we do not know'. For my analysis, the differences between uncertainty, ambiguity and ignorance are less important than that they all play a role in the deliberation about NEST.

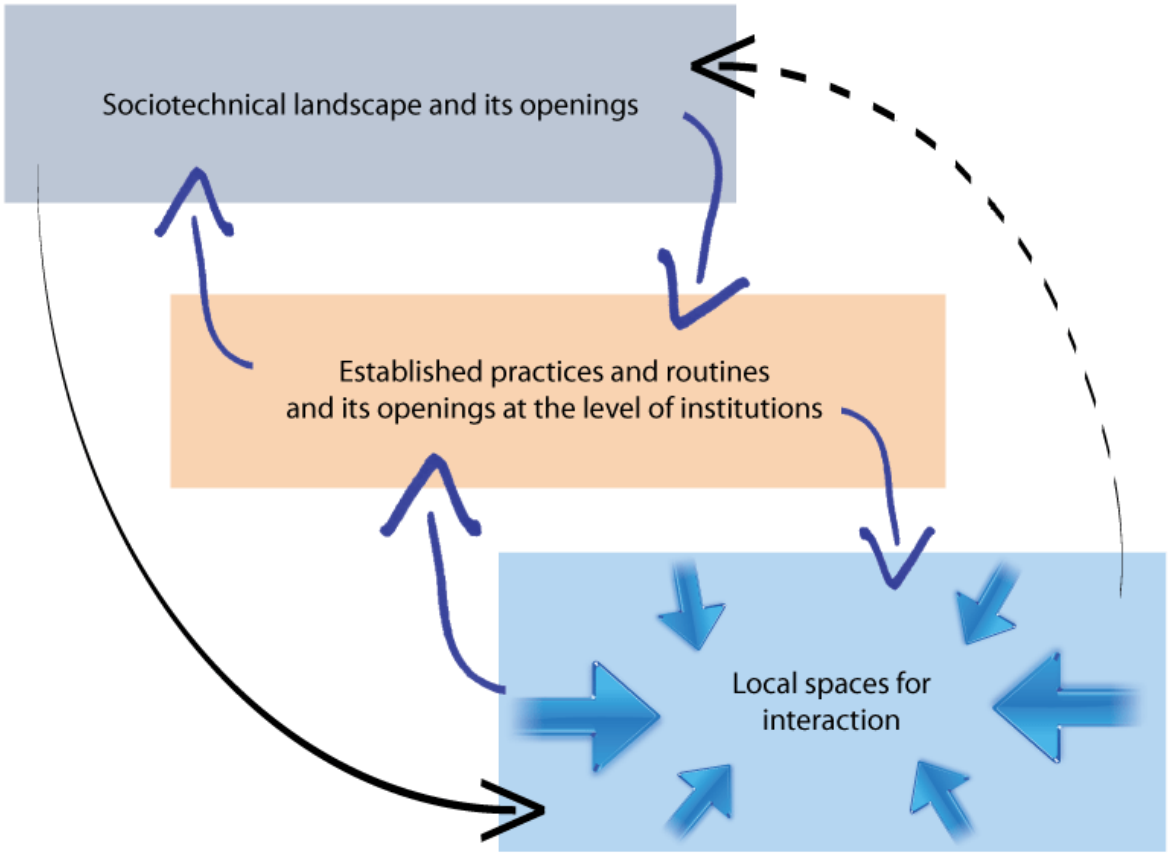
The context of upstream public engagement: deliberation and aggregation at different levels

Whether NEST can be a topic for deliberation between nanotechnology developers and civil society actors, and in what way, does not only depend on the design and orchestration of concrete, local spaces for interaction, but is also shaped by the different institutionalized roles and mandates of actors that are in place. In fact, local spaces where actors can assemble are part of broader configurations that enable and constrain the emergence of spaces for interaction, and what is happening in them.

Inspired by innovation scholars Rip and Kemp (1998), Geels (2005) and Rip (2012) this broader configuration of which local spaces are part, can be phrased in terms of a multilevel context of established practices and routines at the level of institutions for the further development and embedding of new science and technologies, and a slowly changing socio-technical landscape, providing a cultural, and moral backdrop of opportunities and constraints for the type of interactions and collaborations that can be developed.[11] Activities at the different levels and the interactions that take place between the different levels are dynamic, and there are openings for change. What happens in local spaces for interaction may influence developments at the level of institutions. Simultaneously, developments at the level of institutions or within the socio-technical landscape, shape what kind of local spaces for interaction can be organized and how these are filled in. See Figure 1 for a visualization of these dynamics.

[11] Given the criticism of the use of 'level', which tends to reify complex processes, Rip's (2012a) proposal to speak of a multi-layered approach could well be followed. As Rip argues: 'The point is that the context influences the dynamics of innovation journeys in different ways, not that there are different levels in the context' (Rip, 2012a, p. 158, 159).

Figure 1: local spaces for interaction embedded in a broader multilevel context



The discourse and practices of upstream public engagement create openings in the sociotechnical landscape and established routines at the level of institutions, making it easier for nanotechnology developers, other actors like government agencies, and civil society actors to assemble in local spaces for deliberation, negotiation, and aggregation (Rip & Joly, 2004; see also Rip & Joly, 2012). What these interaction processes imply is explained in the main text below.

While the innovation literature often uses this multilevel model of local protected spaces, regimes and sociotechnical landscape to analyse the dynamics of the transition from one socio-technical system to another (see for example how Geels (2005) analyses the transition from surface water to piped water and personal hygiene (1870-1930), in this thesis I will use this perspective to analyze enabling and constraining conditions for having more productive interactions on NEST between civil society actors, nanotechnology developers, and other actors like government agencies.
The current policy of stimulating upstream public engagement creates an opening in the overall sociotechnical landscape, providing opportunities for nanotechnology developers and civil society actors to assemble and jointly inquire into indeterminacy as well as, possibly, creating new relationships, roles and responsibilities. How these openings become further articulated and filled in

is influenced by the already existing infrastructure (for example, division of labour between institutions and ongoing societal agenda-building processes) for handling NEST in society. Just like a real landscape (with motorways, hills and valleys), the sociotechnical landscape enables actors to engage in certain interactions more easily than others (Shelley-Egan, 2011; Te Kulve, 2011). In our society, the travelling through this landscape by technology developers has a concentric pattern: addressing hopeful promises and functional issues first, and sequentially addressing broader aspects like regulations and societal embedding (Deuten et al., 1997). Currently, the upstream engagement discourse, especially when it is part of the move to 'responsible research and innovation', creates external pressure on the established practices and routines at the level of institutions in which the concentric approach is embedded. Nanotechnology developers are now expected (or more or less forced) to step out of their own world to interact and become more responsive to societal needs, and at an early stage, while civil society actors are expected (and stimulated) to become involved and actively participate. This will not occur automatically and it requires reconsideration of existing roles and mandates. Thus, initiatives at one level may induce change on another.

There are solid roles and self-styled but generally accepted mandates. A basic pattern in our society, which actually underlies the concentric approach, is the separation between the promotion and control of science and technology. Nanoscientists and nanoengineers developing and/or promoting newly emerging nanotechnology can work in institutionalized protected spaces (for example, laboratories, start-up firms) to develop vulnerable novelties, or in the words of Mokyr, 'hopeful monstrosities' (Mokyr, 1990, p. 291). Their protection includes a cultural mandate – a purported responsibility to work towards progress, knowledge production and economic prosperity. Anticipating and taking into account emerging societal issues by engaging with civil society actors is traditionally not part of their institutionalized responsibility. Anticipating and articulating societal issues is delegated to other actors, like civil society actors, or government agencies developing regulation to deal with societal impacts of new, promising science and technology developments.

Civil society, both individual citizens and civil society organizations, can be seen as having a mandate as well, namely to be active in the public sphere. Civil society is now positioned (by others as well as itself) as a new actor in the political process of developing NEST in society, but it is not yet clear what this might amount to in terms of institutionalized patterns. This is visible in the discussion about what can and should count as civil society organizations, linked, of course, to the question of how to understand civil society. The nature and scope of civil society differs according to the political theory used (Edwards, 2012). This is not the place to review the debate. I will be practical and follow the distinctions now visible in the governance of nanotechnology and, more generally, between actors with roles in and responsibilities to develop and embed nanotechnology, and civil society

actors. In this context, the widely quoted and applied definition of civil society organizations (CSOs) from the World Bank is useful (2005) (quoted after Laasonen, 2012, p. 38):

> *'Civil society organizations refer to a broad array of organizations: community groups, non-governmental organizations (NGOs), labor unions, indigenous groups, charitable organizations, faith based organizations, professional associations, and foundations.'*

The variety of organizations included in this definition reflects the variety that is currently visible, rather than that it is structured by theoretical considerations. What might be a shared characteristic is that they do not operate in the economic market place and are (except for labour unions) not part of traditional governance arrangements. Additionally, but not visible in the World Bank definition, CSOs can be temporary organizations which disband when they have done their job. CSOs can thus also be very informal organizations, without a legal status – for example, a 'group of citizens' such as a neighbourhood group. The World Bank definition matches the European Commission's DG Research's description of CSOs, defined as:

> *'Organisations that are non-governmental, not-for-profit, not representing commercial interests, and that pursue a common purpose for the public interest. They are responsible for articulating the opinions of various social spheres, and include environmental groups, minority groups, consumer representatives and patient organisations, to name just a few'.*[12]

Sometimes CSOs are equated with NGOs, but in line with the World Bank definition, I will consider NGOs to be one type of CSO, or better, a variety of types, since NGO is itself an umbrella concept covering a variety of organizations with significantly different roles. Laasonen (2012, p. 39) lists a number of new acronyms which have arisen to refer to different roles, ranging from BINGOs (big

[12] ec.europa.eu/research/science-society/index.cfmec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1298&lang=1 (last visited Jan 4, 2013). A more general EC description is: The EU considers CSOs to include all non-state, not-for-profit structures, non-partisan and non-violent, through which people organise to pursue shared objectives and ideals, whether political, cultural, social or economic. Operating from the local to the national, regional and international levels, they comprise urban and rural, formal and informal organisations. They include membership-based, cause-based and service-oriented CSOs. Among them, community-based organisations, non-governmental organisations, faith-based organisations, foundations, research institutions, Gender and LGBT organisations, cooperatives, professional and business associations, and the not-for-profit media. Trade unions and employers' organisations, the so-called social partners, constitute a specific category of CSOs. <eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0492:FIN:EN:PDF>; last visited Jan 4, 2013).

international non-governmental organizations such as ICSU) to DANGOs (direct action oriented NGOs such as the Animal Liberation Front). A useful even if negatively worded characterization is that by Bendell (2000, p. 16):

> *'Groups whose stated purpose is the promotion of environmental and/or social goals rather than the achievement or protection of economic power in the market place or political power through the electoral process.'*

In the concrete cases studied in the empirical chapters of this thesis, the specific nature of the civil society actors involved will be indicated, while the cases will be briefly characterized in Section 1.4.

While civil society actors, whether individual citizens or CSOs, do not have institutional mandates in the development and governance of newly emerging science and technology, their participation is legitimized because they are seen to represent civil society independently of political parties. They can play a role because when confronted with promises and novelties, they are, in principle, in a position to compare and select between different options, up to the point of not stimulating any new science and technology development at all, for example by not buying particular products, or through public protest.

Proposals about how cases of NEST should or could be addressed is mediated by the institutional roles and mandates of actors that are in place. So when nanotechnology developers and civil society actors assemble to have NEST as a topic for deliberation, one can expect not only a diversity of views, but also negotiation about what is at stake, and what should be done. As phrased here, dissensus and conflict in interactions need not derive from diverging assessments of the technology but can be a matter of different views on roles and mandates. For example: How knowledgeable, and in which sense, should a civil society actor be to deserve a hearing from technology developers? Organized spaces for interaction allow, in principle and within certain limits, for dissensus and conflict to occur. This is important because dissensus can stimulate societal articulation processes concerning the technology as well as concerning roles and responsibilities.

Having discussed background issues important to my overall framing of the topic and its analysis, I can now switch and focus on what happens in local, dedicated spaces for interaction. This will be done in two steps: firstly, a critical evaluation of the existing literature on early public engagement spaces, and secondly, presentation of an argument how to do better, by focusing on what I will call public-sphere type interactions.

Section 1.1 Evaluation of upstream public engagement

Upstream engagement activities in nanotechnology have been studied by STS scholars and science communication scholars (see for example Davies, 2008; Davies, 2013; Doubleday, 2007; Hanssen, 2009; Pidgeon & Rogers-Hayden, 2007; Powell & Kleinman, 2008; Rogers-Hayden, & Pidgeon, 2008; Van Oudheusden & De Zutter, 2012). A good entry point to synthesizing the literature is the distinction that Hanssen (2009) makes between interaction with civil society actors where the emphasis is on 'communication as transmission', and what he calls 'communication as transaction'. In communication as transmission, from the world of science and technology to civil society, civil society is characterized as comprising lay people who have no or little awareness of what science and technology are. For a new technology such as nanotechnology, interaction events are designed and orchestrated so as to give citizens an opportunity to become more aware of this new domain. Nanotechnology developers are invited, for example, to science cafés, onto TV programmes, or to workshops to provide information. The problems and limitations mentioned in the literature in this regard are that nanotechnology developers are given the opportunity to position themselves as spokespersons for and guides to a particular nano-world, while others (in this case the so-called lay public) are positioned as an audience that listens (or, perhaps not). They can react and ask questions, but their world, that is, their worldviews, values, concerns and experiences, remains backgrounded. In communication as transmission, there is no opportunity for articulation processes to emerge about emerging societal issues which could then be taken up in research and innovation trajectories or decision-making processes (Davies, 2008; Powell & Colin, 2008).

An example of communication as transaction in the domain of nanotechnology would be policymakers and industrialists attempting to become aware of the concerns and values of civil society with regard to risks and safety issues by inviting civil society organizations such as non-governmental environmental and consumer organizations to join multistakeholder consortia, for example, concerned with risk assessment and risk management (see for example NanoKommission, (Pfersdorf, 2012), and the Dutch Sounding Board on Risks of Nanotechnology).[13] These CSOs are positioned as 'voice of civil society' and are expected to articulate societal issues and concerns in multilateral deliberations. There will, in principle, also be opportunities for societal learning and articulation processes.

[13] For more information on the NanoKommission, see www.bmu.de/service/publikationen/downloads/details/artikel/ergebnisse-aus-der-zweiten-nanodialog-phase-2009-2011/. For more information on the Dutch Sounding Board on Nanotechnology, see www.rijksoverheid.nl/onderwerpen/nanotechnologie/risicos-nanotechnologie.

In practice, there are two striking features of the ongoing 'transactions' in current upstream public engagement activities. Firstly, technology developers are not expected to point out societal issues or concerns, which is considered the responsibility of others, including civil society actors. Such a division of moral labour goes with a further framing of the situation whereby civil society can have voice, but not influence. Civil society is positioned as a collective in its own right, existing 'out there', and separate from groups of actors who see themselves as responsible for the development and embedding of newly emerging nanotechnology. It is seen as a collective with whom government agencies, scientists and industrialists can initiate a dialogue if they desire to become more aware of societal needs and concerns. They can, in principle, take the concerns, doubts and issues of civil society up in decision-making processes, but that is their decision.

This leads to a second feature, the assumption that societal issues or concerns are out there and that members of civil society can recognize and articulate these. However, considering that newly emerging nanotechnology is still under construction, societal issues and concerns might not be out there, but emerge because of on-going development of nanotechnology and discussions about them. The kind of societal issues that might emerge will depend on (or be shaped by) the kinds of considerations, decisions and actions that are undertaken by scientists, industrialists or policymakers. For example, the choices that government agencies or funding agencies make with regard to sponsoring certain science and technology developments will influence which promises can be further developed by scientists in R&D laboratories. In other words, the activities of scientists or industrialists, such as developing certain functionalities of medical devices, influences which actions users, for example patients, can or cannot take. The activities of one group of actors will set enabling and constraining conditions for the actions of other groups. In general, activities are entangled one way or another. Together, these activities add up to emerging patterns concerning how a new technology can materialize in society and which values, norms, roles and responsibilities might become dominant and which ones will be silenced or remain underdeveloped. Thus, to be able to deliberate upon and anticipate emerging societal issues occasioned by the development of nanotechnology, these have to first be discovered and articulated. This is a form of inquiry which can be addressed in organized spaces for interaction.

While I offered a critical evaluation of transmission as a way to engage civil society, this does not imply that I find that communication as transmission has no value. Because nanotechnology is newly emerging, there is little awareness in the general public, and the provision of information can address this. However, opportunities for more reflexive societal learning and articulation processes upon which better informed decisions can be made will be lost if upstream engagement is limited to the provision of information. The key point is that indeterminacies should be recognized and

addressed. Nanotechnology is new and indeterminate for everyone, and no one has a complete overview of what is or might be at stake. In order to have more reflexive societal learning and articulation processes with civil society actors as new dialogue partner, the challenge is how to overcome the current a priori distribution of roles and responsibilities in upstream engagement activities and design and orchestrate spaces in which more symmetrical interactions can be pursued. Symmetry in this case does not mean equality: the institutional roles and mandates of nanotechnology developers and civil society actors remain different. It refers to a situation in which both nanotechnology developers and civil society actors share and discuss their activities, and inquire into how these are entangled, thereby discovering and anticipating emerging societal issues occasioned by the development of newly emerging nanotechnology.

What sort of requirements have to be addressed in the design and orchestration of spaces that allow for these type of interactions? I can offer some initial thoughts, taking note of recommendations made by scholars in the field of public engagement and science communication, but not picking up on them here in detail. Frequently used approaches to the study and analysis of interactions focus on actors and their actions and intentions (for example, discourse analysis or discursive psychology (Van Oudheusden & De Zutter, 2012; Te Molder, 2011) and/or on the design and orchestration of the actual interaction event, including practical questions about the organization and the role of the moderator (see, for example Verhoeff & Waarlo, 2011). Recommendations focus on better formats through a better allocation of time and resources (Davies, 2008; Powell & Colin, 2008), or develop better evaluation criteria for participation processes (Rowe & Frewer, 2000). While improving interaction processes in actual spaces for interaction is important, they reflect only one part of the challenge. My priority in determining what might be good spaces is to explore how a different division of labour between nanotechnology developers and civil society actors can materialize in society to address indeterminacies occasioned by the development of nanotechnology. To this end, it is also important that mandates of actors allow for symmetrical interaction on NEST, and that there are affordances in society for actors to assemble. One important issue is transparency. In order to discover and anticipate emerging indeterminacies occasioned by the development of NEST, activities and considerations made at the locations where NEST is developed, like laboratories, should become visible, so others can respond to it. It is not obvious how this can be done, though. Adding to the complexity is the fact that choices that influence development and eventual embedding in society, are not only made in laboratories, but also in firms and government agencies. These add up to certain outcomes, i.e. aggregation occurs. Ideally, concerns articulated in public engagement should be part of the aggregation process. Thus, there is a background requirement to having good spaces which can be formulated in terms of the political-

theoretical notion of the public sphere. I will discuss this first, before returning to the specific requirements for good spaces.

Section 1.2 A background requirement: an adequate public sphere

Good spaces are part of wider contexts, within which there must be a certain willingness (and I add, competence) to take up NEST as a topic for deliberation by nanotechnology developers, other stakeholders such as government agencies and civil society actors. This is typically what a public sphere is supposed to do. But to have NEST as a topic for deliberation, requires an extension of the traditional public sphere. It is worthwhile to go back to the basic aspects of the public sphere and then explore the challenges involved in including NEST. One immediate implication is that public-sphere type interactions are relevant to take into account in the design of good spaces. An analysis of what these interactions are requires further input, including from philosophers such as John Dewey and Hannah Arendt, who developed interesting approaches to the public sphere. In Chapter 2, this will be one of the topics to discuss. Here, I am only laying the groundwork so as to be able to outline (in Section 1.3) how I will approach my study of good spaces.

Basically, the public sphere refers to a sphere or diffuse space in society where members of society (not related by social ties, so in a sense, strangers) can participate as knowledgeable actors in extended deliberations and negotiations (reaching across space and time) by bringing up ideas and opinions for exchange and offering arguments on matters of common concern.[14] It is a non-localized space in which different stakes, values, needs and concerns can be articulated, and there is allowance for dissensus, conflict and disagreement. The public sphere is a space for continuous inquiry into what is happening in society, and a space in which articulation processes can occur concerning what is at stake, and for whom, upon which, in principle, better informed decisions can be made.

There are all sorts of local spaces for deliberation which can emerge spontaneously or are purposefully organized. People assemble in local spaces for some purpose, for example to acquire a better understanding of particular issues. The public sphere, however, in the words of Taylor (2002):

[14] The term 'knowledgeable actor' does not imply that every actor (participant) has the same degree of knowledge on particular things, but it refers to the situation that in the public sphere, in principle, every participant is knowledgeable, albeit on different things. For example, in relation to healthcare, doctors and nurses are knowledgeable with regard to the functioning of the human body, healthcare insurance companies are knowledgeable with regard to reimbursement issues, and patients have a particular (lived) experience about having, or living with, a disease.

> *'(…) transcends such local topical common spaces (…) it knits a plurality of spaces into one larger metatopical common space of non-assembly (…) The same public discussion is deemed to pass through our debate today, and someone else's earnest conversation tomorrow, and the newspaper interview Thursday, and so on.' (p. 113, 114)*

Here, Taylor points to the fact that discussions are extended over time and through a variety of media, so outcomes related to one local space can be input for discussion in another context and with other participants. What makes the public sphere a common space, as opposed to merely convergent, is that deliberations purposefully revolve around a common object or goal, rather than each person just happening, on his or her own, to be concerned with the same thing (Taylor, 2002, p. 113, 114). What is common is not clear beforehand, and its commonality has to be articulated and negotiated. One way to pursue this, following Dewey (1927), is to consider matters related to communal ways of living, in cities, nations and the global world,[15] and aggregate, up to reaching (where possible) a common judgement or public opinion, on what is at stake and how to move forward. For NEST, one cannot fall back on existing communal ways of living because it is not clear how NEST will develop and become embedded in society.

The public sphere provides the opportunity to discuss and investigate issues that relate to coexistence – the dependency of humans on others. As Dewey and Arendt argue (see for more details Chapter 2), there are no clear demarcations between private and public spheres. Which issues are public and which private must be continuously redefined and negotiated in relation to new, changing circumstances. As such, the public sphere is not a fixed, singular sphere in society. What the public sphere looks like depends on the way a society shapes itself.

Taylor (2002) interestingly refers to the public sphere in terms of a shared 'social imaginary', a projection that may to some extent be materialized and justifies concrete materializations. A social imaginary is part of the creative and symbolic dimension of the social world which includes institutions, laws, symbols and routines through which humans create their ways of living together.[16] A social imaginary exists in the sense that a large number of people in society attach value to it and act in that way:

[15] Public sphere is often positioned as opposed to private sphere (home, family), which is not separate from communal life in societies, but need not be topic of deliberation. Of course, these boundaries are themselves up for discussion.

[16] Taylor actually also sees the Church and State as social imaginaries. In the STS literature the concept of sociotechnical imaginary has been proposed by Jasanoff & Sang-Hyun (2009), which is similarly located in the symbolic dimension of the social world, but refers to a historically developed pattern in a country, e.g. about nuclear energy.

'A public sphere can exist only if it is imagined as such (…) Unless all the dispersed discussions are seen by their participants as linked in one great exchange, there can be no sense of resultant public opinion.' (p. 112)

This is a strong claim, but one that recognizes such considerations in the present push for anticipatory deliberation on NEST. Thus, there is reason to consider the possibility of an extension of the public sphere to include NEST.

In general, the public sphere evolves: referring back to classical Greece, in the Greek *polis* (city state), people (specifically, free men) were able to assemble and engage in face-to-face interaction in the *agora*, which was a physical space located in the centre of a city. Interactions in the *agora* were not undertaken to make decisions, but a prelude to decision-making. In the *agora*, men had the opportunity to share experiences, doubts, dilemmas, wishes and listen to those of others. After discussion in the *agora* delegates went to the *ekklesia* (a different physical space) to make decisions based on the things they had heard in the *agora* (Davenport & Leitch, 2005). Whereas face-to-face contact was part of the public sphere in Greek city states, with the increased possibility of using documents, including letters and pamphlets, the public sphere that emerged in Western societies in the eighteenth century did not depend on such contacts. It was a 'nonlocal metatopical common space of non-assembly' (Taylor, 2002, p. 114), in which people who never met face to face understood themselves to be engaged in discussion and capable of reaching a 'common mind' (p. 112).[17] Together with the emergence of the nation-state, Taylor (2002) argues that the idea arose that 'political power must be supervised and checked (…) by a kind of public discourse' (p. 114). This is visible in the publications (for example, books, pamphlets, newspapers) that circulated among well-to-do people and how their contents were taken up for discussion in local spaces such as coffee houses, theatres and salons (Taylor, p. 112, 113).

'Any perceived general view that resulted from all this, counted as public opinion.' (Taylor 2002, p. 112)

Such developments continued over the next centuries, with more people becoming involved, also because of the spread of education. There is continuity, as well as emergence of further features, such as populist dynamics (from its original shape around 1900 to present-day media-driven

[17] Cf. Habermas (1989) The Structural Transformation of the Public Sphere.

democracy). Recently, social media such as Facebook, Twitter and Blogspots have created virtual meeting spaces where people become linked through discussions that extend over time.[18]

As this brief historical sketch shows, the public sphere is not just a construct discussed in political theory leading to debates on what constitutes a good public sphere and what are the ideal relations between individual citizens and broader, organized, communal ways of living (Calhoun, 2012), but also a phenomenon out there, in our societies, and as such a practical concern: How do we maintain the functioning of the public sphere? It is in this spirit that I signalled the difficulties that the public sphere has in addressing newly emerging science and technology as a topic for deliberation, but also saw opportunities in upstream public engagement, especially if this engagement is part of the general move to responsible research and innovation. What is happening now with upstream public engagement can be seen as experiments with what could become an extension of the public sphere, where NEST is a topic for societal deliberation.

The broader import of increasing public engagement with science and technology has been pointed out by other authors. Nowotny et al. (2001) speak of recontextualization of science in society, devoting a chapter at the end of their book to a proposed *agora* for the twenty-first century as the way to go. While this is a reference to the Greek *polis*, the notion is taken more broadly, more or less to a public sphere and to concrete spaces for assembly and deliberation. Callon et al. (2009) discuss what they call 'technical democracy' as a way to address the problem of acting in an uncertain world. This phrase is perhaps not ideal because an extension of the public sphere is not primarily about democratic procedures, but about types of interaction between heterogeneous groups of actors in the public sphere.[19]

Whether such an extension will actually be realized remains to be seen. Routines at the level of institutions, best practices or other models that actors can draw on may emerge and stabilize, or they may not. What their shape will be cannot be specified up front. The study of this emerging phenomenon is important for my topic of what could be good spaces where NEST can be a topic for deliberation, because it now allows the formulation of the question as one concerning the occurrence of public-sphere type interactions and their effect. The further question about what these interactions might add up to, for example, outcomes of local interactions visible at the

[18] Combined with the coordination effect of exchanges through the internet and mobile telephony, this creates fertile soil for collective action, earlier in the downfall of the Soeharto regime in Indonesia in 1998 (Lim, 2005) and more recently as an input in the Arab spring changes, starting in 2010, cf. www.washington.edu/news/2011/09/12/new-study-quantifies-use-of-social-media-in-arab-spring/, as well as the Occupy movement in 2012.

[19] I see a vital public sphere to be an essential condition for democracies to be more than procedural; cf. the idea of the citizen as more than a voter.

collective level of society and other actors in other contexts connecting to them, can be considered in a preliminary fashion only (because I will have only limited relevant data), but will allow me to explore whether there are indications of an extended public sphere.

By public-sphere type interactions I refer to interactions that are characteristic for the public sphere, such as participants having the opportunity to express their issues, needs and concerns in relation to matters of public concern. I do not call them 'public sphere interactions', for two reasons. First is that I trace such interactions within dedicated spaces rather than within the overall public sphere. Second, as different requirements may well be needed for NEST to be a topic for deliberation in the public sphere compared to those usually ascribed to interaction and participation in the public sphere, I may have to extend the types of interactions. This is actually something I will do conceptually in Chapter 2.

However, one difference from classical public sphere theory can already be mentioned. For NEST, with its characteristic indeterminacy, the public or common concerns upon which people engage and deliberate in the public sphere are themselves unclear. What the dimensions of the issues might be is a topic of inquiry, with anticipation of what might occur also playing a role. In addition, there will be different assessments and possible controversy, as has been emphasized and empirically analysed in the STS literature (e.g. Latour (1987), Wynne (2001), Bijker (1995) and Rip (1986). Thus, a turn to articulation of issues is already one requirement. This was already been emphasized by Marres (2005, 2007). She argues that in designing and orchestrating public involvement in science and technology developments, procedural models are followed all too easily, focusing on 'accountable decision-making', or 'representation', while the question of what is actually at stake, and for whom, is not addressed. Thus, in public participation more attention should be paid to the articulation of issues occasioned by the development of new science and technology, and which are in need of settlement (Marres, 2007, p. 763, 764). In fact, as Dewey has emphasized, when articulated, issues call a public into being. To Marres's turn to issues, I have added a further turn, the turn to spaces. Spaces enable and constrain the kind of interactions that can take place within them, and through their location and links, how outcomes can be accommodated in development trajectories and decision-making processes (this is where multilevel dynamics come in, see Figure 1).

Section 1.3 Research design and methodology

What is distinctive for the framing I have developed thus far is that it focuses on spaces for interaction and how these work, and puts them into context (which is seen as multilevel). What

constitutes good spaces for interaction should not be determined solely in terms of whether they instrumentally achieve the goals that have been set somehow, but should also draw on general considerations, such as the importance of inquiry and public-sphere type interactions which still have to be articulated further, partly drawing on Dewey's and Arendt's perspective (see Chapter 2). This informs my research question:

> *'What could be good spaces for interaction where civil society actors and actors with roles and responsibilities to develop newly emerging nanotechnology, in interaction and in relation to emerging indeterminacies, can deliberate upon nanotechnology and its emerging societal issues, with the possibility that outcomes are taken up to modify innovation and societal embedding trajectories?'*

Actually, this is a double-loop research question, moving between an empirical one (What is happening?) and an evaluative one (Is it good what happens, instrumentally or more broadly?), which then raises questions about what counts as 'good'. Discussion of the question what is good, can be stipulative, as philosophers tend to do, but there must be iterations between tentative stipulations and the empirical and evaluative questions. I will therefore divide the research question into two.

First, the empirical question: Which spaces occur already in the development and governance of newly emerging nanotechnology that allow for public-sphere type interactions, how are these spaces constructed and orchestrated, and with what outcomes? I will consider four case studies, or sites where such interactions might occur.

Second, the conceptual question: What are the requirements for good spaces that allow for public-sphere type interactions? And eventually translate these into suggestions for organization and design, taking into account wider contexts. The second question entails both a philosophical and an empirical approach. The background theme of a possible extension of the public sphere to address NEST will be explored on the basis of the evaluation of the concrete spaces, not as a separate research question.

Philosophical study

In Chapter 2, I will start to consider philosophical backgrounds to my question about good spaces and good interactions. This must include discussion of the public sphere and how newly emerging science and technology can be included as a topic for deliberation. In doing this, I build on of a tradition of

scholarly work and reflection in philosophy and Science and Technology Studies (STS). Examples are Dewey (Dewey, 1927), Arendt (Arendt, 1998), Habermas (1989) Rip and Joly (2012), Callon (2009) and Jasanoff (2004). Several scholars have considered the question of what might be good spaces in which new science and technology developments can be a topic of deliberation, and some have developed requirements concerning the nature of such spaces. I will concentrate on the philosophy and programme of Constructive Technology Assessment (CTA), the political philosophy of Dewey and the philosophical anthropology of Arendt. These are the most appropriate because for all three philosophies the point of departure for developing requirements for good spaces is the occurrence of indeterminate situations caused by the introduction of novelties in existing frameworks. Dewey, Arendt and CTA pay attention to spaces as a way to purposefully steer or modify what is happening more reflexively: Dewey discusses the formation of 'publics' (I note that this is different from contemporary notions of 'civil society' or 'general public') in relation to indeterminate situations, and the creation of spaces for assembly, in which a public can inquire into indeterminacies and develop explicit understanding in relation to the new. Arendt discusses the classical Greek notion of *agora* (especially in Athens) as a paradigmatic model for a public space where humans can acquire explicit understanding in relation to indeterminacy by performing the activity of 'action', which in Arendt's anthropology is the highest human activity, compared with labour (to survive) and work (to create artefacts). As will be further argued in Chapter 2, it is in the activity of action, that people put their existing roles, values, ideas, and responsibilities 'at risk' in the public sphere, and develop new, or more adapted ones. CTA has developed activities and objectives to design dedicated spaces in an early stage of an innovation trajectory with the aim of anticipating future developments, and stimulate better (that is, more encompassing, more reflexive) strategy articulation in the here and now. In the philosophies of Dewey and Arendt, these spaces are not intended to merely create more and better deliberation, but also to have outcomes visible so that these can be taken up in other spaces for deliberation. In their philosophies, spaces for assembly are connected with the good functioning of democratic societies (I will elaborate on this further in Chapter 2).

A further consideration behind the focus on Dewey, Arendt and CTA is that public-sphere type interactions have to occur between actors with different (even conflicting) roles, mandates, responsibilities and authority. These differences influence the perspectives of actors, enable and constrain what type of interactions can be pursued and if and how societal issues can be taken up in innovation trajectories. As I will show in Chapter 2, heterogeneity between actors is constitutive in the work of Dewey and Arendt. This contrasts with the bracketing out of heterogeneity for the sake of reaching a universally valid and impartial consensus, as with Habermas's ideal of acting in the public sphere (Habermas, 1989), or with Rawls's notion of ideal interactions in the public sphere

taking place via the construct of a veil of ignorance (Rawls, 2002). Actually, the quality of spaces for assembly and interaction is enhanced when the inherent heterogeneity, ambiguity and complexity that exist in relation to novelties is unveiled and articulated and becomes a resource to draw upon, for example in developing new values, norms, roles and responsibilities.

Empirical study

In my first-round evaluation of the literature, it became apparent that currently very few public-sphere type interactions occur in upstream engagement activities. However, this is not the whole picture. As part of the new upstream engagement discourse, spaces for interaction have been created where deliberation, negotiation and aggregation are possible. There are now cases that at least partially show the ideal of all kinds of actors participating as knowledgeable actors, sharing their views, perspectives and concerns, and jointly inquire into an indeterminate situation and articulate what is at stake and what should be done. When adding the multilevel perspective, one can see additional relevant activities, for example, changes in the discourse of chemical industry by positioning civil society actors as stakeholders whose views have to be heard, rather than lay people in need of more information. I will select four spaces to examine in which the development and/or governance of newly emerging nanotechnology has been a topic for deliberation between civil society actors and those with institutionalized roles and mandates to develop and embed nanotechnology. In doing so there is some assurance that I will see interesting things, and be able to analyse if and how public -sphere type interactions occurred. The choice of the four spaces was further guided by two considerations. First, because it is not yet clear what constitutes a good space in which nanotechnology developers and civil society actors can interact, my aim is to cover a variety of current spaces that allow for interaction and participation of civil society actors. Thus, I can gain insight into the different opportunities that currently exist for actors to assemble, evaluating what works (or not) and why on a case-by-case basis, but within a common conceptual framework. A second, more pragmatic, consideration concerns data collection. A prerequisite was that as an analyst, I should have access to local spaces for interaction (ideally as a participant observer, or otherwise in retrospect by interviewing participants, and document analysis). In addition I also needed the opportunity to gain insight into mutual dynamics between local spaces for deliberation, and the wider political and cultural contexts in which the local spaces are embedded. In doing so, I concur with the analysis and recommendations set by STS scholars Joly & Kaufman (2008), Marris et al. (2008) and Bickerstaff et al. (2010). These authors critique the currently dominant trend in public

engagement and science communication literature to solely study and evaluate actual interactions in local spaces, and urge scholars to take a multilevel perspective and analyse how broader institutional and cultural contexts shape processes and outcomes of actual dialogue events, and vice versa. How the data was collected and how the multilevel dynamics were analysed will be elaborated upon in the empirical chapters. The four spaces for interaction that were selected for closer study will be briefly characterized below. These spaces are interesting as partial successes, but also from the instructive failures that occur.

The first type of spaces for assembly can be seen in co-construction projects between industry and civil society organizations (CSOs) within the development and governance of newly emerging technologies (Chapter 3). I focus on a three-year partnership between chemical company DuPont and a non-governmental environmental organization Environmental Defense Fund (EDF). This partnership was set up because both actors were interested in inquiring into and anticipating an issue of public concern: to fill in a governance gap with regard to identifying and managing health and environmental risk and safety issues related to nanoscale materials. DuPont and EDF considered the development of a risk framework to be an adequate way of addressing this issue of public concern. By studying this empirical site, we gain insight into how these groups of actors that traditionally operate quite separately in the development of a new technology and its embedding in society – managed to realize a co-construction project. This partnership also shows how co-construction projects between industry and CSOs evoke ambivalent responses in our society: when DuPont and EDF launched the risk framework in the wider world, the partnership itself and the framework developed met with appreciation as well critique, up to rejection.

The second type of spaces for assembly is visible in capacity-building programmes for CSOs, funded by the European Commission (EC) (Chapter 4). Civil society organizations are increasingly positioned by the EC as potential sources of 'knowledge, know-how and innovation', who could act as partners in research trajectories and, as such, contribute together with industry, science and policy, to a European knowledge-based society, one that is responsive to 'societal needs and concerns' (EU, FP6). However, the EC argues that for CSOs to take up this role, they first need to develop competences to do so. As a result, over the past years, the EC has been providing resources for CSOs to develop competences. By studying competence-building projects for CSOs, insight can be gained into how CSOs take up these new roles and responsibilities that are assigned to them by policymakers. I focus on one capacity-building project called NanoCap, established for environmental organizations and trade unions to develop positions on environmental, occupational health, safety and ethical aspects

of nanotechnology. What makes the NanoCap project additionally interesting is that for most of the participants the development and governance of nanotechnology was initially not a matter of concern. The CSOs took part because they were invited to participate.

Chapter 5 studies spaces for assembly that were part of the Dutch Societal Dialogue on Nanotechnology. It also examines the goals, setup and outcomes of the Dialogue so that the multilevel configuration is covered explicitly. The Societal Dialogue was an attempt of the Dutch government to open up to new inputs in policymaking on NEST by stimulating stakeholders and Dutch citizens to inquire into and articulate societal issues. The actual detailed design of the spaces for assembly was delegated to a Committee, within bounds specified in its mandate. The Committee itself was not a partner in the actual interactions (except for a few ad-hoc meetings), but stimulated distributed activities by funding bottom-up proposals for interaction initiatives. From the outset, there were mutual entanglements and dependencies in this multilevel configuration: activities at the policy level and by the Committee created a certain space in which project leaders at the microlevel could shape the design and content of their activities. The outcomes of the activities were used as input in official reports and policymaking. By studying this empirical site insight can be gained into the dynamics between the various levels, and how these enabled and constrained spaces for interaction. An additional advantage of studying this empirical site was that the Societal Dialogue was set up in Dutch society to extend the public sphere (and some of the Committee members also thought in those terms) by enabling opportunities for experience and competence building to deliberate, in particular with regard to ethical and societal aspects of nanotechnology, explicitly differentiated from risk and safety issues.

While Chapters 3, 4, and 5 study spaces for interaction that were designed and orchestrated by others, Chapter 6 reports on the interactions occurring within three spaces for assembly which I designed and organized myself with the explicit purpose to stimulate public-sphere type interactions. I developed the design based on existing experience with CTA workshops, adding requirements derived from the analysis of Dewey's and Arendt's approaches in Chapter 2. These spaces functioned as a sort of prototype, allowing the testing of whether and how the design requirements that were formulated in general philosophical terms were actually productive in practice (productive in the sense of stimulating public-sphere type interactions in relation to NEST). The spaces for assembly that were organized, that I have named CTA+, were workshops designed as a microcosm. In these spaces actors operating in separate, but not independent, worlds could meet and in interaction,

inquire into real-world indeterminate situations, in this case changing societal norms, values, roles and responsibilities occasioned by the introduction of novel nano-enabled applications in healthcare.

Acknowledgements

Some chapters draw on published or submitted papers in peer-reviewed journals. These are listed below in order of the chapters to which they relate.

Krabbenborg, L. and Mulder, H. (to be submitted to *Science Communication*) Upstream public Engagement in Nanotechnology: Constraints and Opportunities of Multilevel Configurations

Krabbenborg, L. (2013) DuPont and Environmental Defense Fund Co-Constructing a Risk Framework for Nanoscale Materials: An Occasion to Reflect on Interaction Processes in a Joint Inquiry. *Nanoethics* (vol. 7, issue 1; p. 45-54)

Krabbenborg, L. (2012) The Potential of National Public Engagement Exercises: Evaluating the case of the recent Dutch Societal Dialogue on Nanotechnology. *International Journal of Emerging Technologies and Societies* (vol. 10; p. 27-44)

Krabbenborg, L. (2013) Dramatic Rehearsal on the societal embedding of the lithium chip. In: T. Swierstra and S. Van der Burg (eds): *Ethics on the Laboratory Floor: Towards a cooperative ethics for the development of responsible technology.* Palgrave/MacMillan

Krabbenborg, L. & Van der Windt, H.J. (2011) Veranderende rollen, waarden en praktijken rondom point-of-care diagnostiek. *Ned Tijdschr Klin Chem Labgeneesk* (vol. 36; p. 41-44)

Chapter 2 Spaces for assembly in and for a changing world

Introduction

As discussed in Chapter 1, there are now openings in political processes in Western societies to include societal needs and concerns in the development of newly emerging nanotechnology by involving civil society actors, that is, individual citizens and civil society organizations (CSOs), as new dialogue partners. Currently, these interactions between nanotechnology developers and others such as governments and civil society actors are pursued in terms of upstream engagement, in which a simple distribution of roles and responsibilities is visible: nanotechnology developers are expected to provide factual know-how and civil society actors are expected to recognize and articulate emerging societal issues. I have argued that such an arrangement reduces the actual complexity. Considering that nanotechnology is still under construction, societal issues might not be 'out there', and thus cannot simply be recognized and brought to attention by civil society actors. Rather, the development of nanotechnology and its societal issues mutually shape each other. The kind of societal issues that might emerge depends on what kind of considerations, decisions and actions are taken by actors who have roles and mandates to develop or embed newly emerging science and technology (NEST), such as scientists, industrialists and policymakers. The activities of one group of actors set enabling and constraining conditions for actions of other groups. In general, these activities are entangled one way or another. Together, they add up to emerging patterns of how a new technology can materialize in society and what the societal impacts might be.

The challenge is how to bring complexity back in, in general, and particularly how to overcome the division of labour between nanotechnology developers and civil society actors visible in upstream engagement activities. A key approach is to create spaces for assembly that allow for public-sphere type interactions in which both nanotechnology developers and civil society actors share and discuss their activities, and inquire into how these are entangled in order to discover and articulate emerging societal issues. The philosophies of Dewey and Arendt and the thinking and approach of Constructive Technology Assessment (CTA) offer arguments why this is a key approach. In this chapter I will also investigate how these philosophies allow me to explore what can and should happen in spaces for assembly that allow for public-sphere type interactions.

In their general philosophy both Dewey and Arendt explore how humans can live a meaningful life in an ever-changing world, and they both include consideration of the development and societal embedding of science and technology. Both perceive science and technology as catalysts of change and as a source of contingency, unpredictability and unknowns because of the novelties

that they introduce into the existing order. Constructive Technology Assessment is not formally a philosophy, but with its overall goal of contributing to realizing 'a better technology in a better society' (Schot & Rip, 1997), and doing so by improving reflexivity throughout the innovation chain and the embedding of technology in society, it does imply a diagnosis of society and how it tries to handle new technology (Rip & Robinson, 2013).

My reference to Dewey and Arendt is to indicate that we do not have to start from the very beginning when considering how civil society actors can become involved as new dialogue partners in newly emerging science and technology. At the same time, I should not use their insights without further consideration. Dewey (1859-1952) and Arendt (1906-1975) both lived in the twentieth century and were responding to their contemporary situation. Thus, I should also reflect on how attempts to handle new science and technology in society have evolved since their time and evaluate what this implies for requirements for good spaces for assembly in the twenty-first century.

One difference is the prominence of newly emerging sciences and technologies, and their promises (and concerns they raise) in our society, already visible in ICT, but definitely important with biotechnology, genomics and now also nanotechnology. Dewey and Arendt developed their thinking in relation to existing technologies which were already part of a common world and a lived experience in people's daily lives, such as railways and automobiles in the case of Dewey, or television and newspaper reporting with regard to the launch of the Sputnik in the case of Arendt. Newly emerging nanosciences and nanotechnologies are mainly hopeful promises and expectations, and do not yet exist as concrete products and systems embedded in a common world where society at large experiences concrete dilemmas and faces other issues. NEST does exist, but in the form of visions, promises, expectations and concerns. Promises (and concerns) are not mere words, but also have agency. Since promises serve as a justification for investment in particular research and innovation trajectories, they are a key dynamic in shaping innovation processes. Moreover, promises travel to worlds other than those they were generated in, and can set promise-requirement cycles in motion that enable and constrain how novelties are developed and become materialized in society.[20]

[20] For example, the promise of care-at-a-distance is seen as a solution to the problem of the increasing number of aged and chronically sick people who are in need of care, while at the same time hospitals are understaffed. This overall vision justifies current investments in the development of devices and systems, for example body-area-networks (BAN) that enable care-at-a-distance. BAN refers to a wireless network linking wearable or implantable sensors and processors that constantly monitor physiological conditions with the outside world, such as heart rate, blood sugar, brain activity and muscle tension. BAN is currently at an intermediate stage of development: R&D prototypes and some limited applications (Parandian, 2012). There are some promise-requirement cycles, some on the technical side, as in the HUMAN++ project (where requirements on low energy use are driving R&D), others linked to the health-care setting, integrating sensors, ICT and new responsibility arrangements.

In Section 2.4, I will outline how these promise-requirement cycles offer one entrance point to the design and orchestrating of good spaces for assembly, where nanotechnology developers and civil society actors can inquire into entanglements and articulate problematic issues.

Another difference is that a cultural repertoire is visible in our society that enables and constrains how NEST can be a topic for deliberation between technology developers and civil society actors. A repertoire functions as a toolkit and provides actors with a historically transmitted and publicly available system of symbols, myths, world-views and stereotypes from which actors can draw certain elements to make sense of particular situations and shape their actions (Swidler, 1986). In our Western societies, risk and privacy issues related to new science and technology can become a topic for deliberation between different actors relatively easily because by now, there is a cultural repertoire available for these issues on which actors can fall back. There are examples from earlier technologies that can be mobilized, and there are professional institutions that have mandates and responsibilities, for example, to study toxicity of chemicals, including nanoparticles, and/or to monitor and inform citizens about health risks and environmental damage.[21] For other societal issues, such as the way technology shapes how we relate to the world and to each other, and how it might change the way we value certain behaviours and norms (Boenink et al., 2010; Feenberg, 1999; Swierstra & Te Molder, 2012), there is much less of a repertoire available for actors to use as a toolkit.[22]

The third difference is how the involvement of civil society is now actively sought by policymakers and has thus acquired legitimacy. However, this move has given rise to a division of labour between technology developers and civil society actors, where the former are responsible for development and expected to push for it, and the latter are expected to voice appreciation and/or concern – often in terms of current cultural repertoires. There are also attempts to bridge the gap between technology promotion and societal concern. Constructive TA is one such attempt, and over the last ten years it has built up experience in bridging this gap by creating dedicated spaces for assembly with respect to emerging nanotechnology, as well as understanding the patterns that are evolving.

Given these changes in our present-day situation, it is necessary to explore what good spaces could be here and now, building on the substance of Dewey and Arendt's insights rather than on the specific form in which they were presented at the time. Chapter 1 argued that good spaces allow for

[21] In the Netherlands, RIVM, the public research institute for public health and environment, would be an example. See www.rivm.nl/Onderwerpen/Onderwerpen/N/Nanotechnologie/Kennis_ en_informatiepunt_risico_s_KIR_Nanotechnologie

[22] The current focus on risk and safety issues can be understood against the background of the liberal democratic constitution of Western societies where the 'no harm' principle is one main trait (Mill, 2002).

and stimulate public-sphere type interactions. Traditional public-sphere interactions may not be adequate for deliberating on newly emerging science and technology, so it is important to go back to basics. This is where Dewey and Arendt's insights come in as input into my outlining of what might be features of public-sphere type interactions relevant to deliberating on NEST. This is a complex task which will be addressed in two steps: firstly, I will discuss the relevant elements in the philosophies of Dewey and Arendt (Sections 2.1, 2.2. and 2.3) and how these can be applied, with modifications, in the twenty-first century (Section 2.4); and secondly, I will reduce the complexity of the situation by building on the experience of CTA (Section 2.5) and create a Table specifying public-sphere type interactions that will be used to map what occurred in the four empirical cases studied in this thesis (Section 2.6).

The mapping of public-sphere type interactions that occur is important for an analysis of the relation between the creation of spaces for interaction (sometimes to realize a product, in other cases to enable public-sphere type interactions) and the eventual outcomes. This will allow me to address the question of designing good spaces by identifying what design requirements could be on the basis of empirical cases (this will be done in the empirical chapters and integrated into the concluding Chapter 7). Another input into the question of designing good spaces is the experience of CTA (Section 2.5), while insights from Dewey and Arendt (Sections 2.2 and 2.3) also play a role. Further design requirements derive from the embedding of spaces for interaction in multi-level configurations, as indicated in Chapter 1, and the importance of outcomes of deliberation in local spaces be taken up elsewhere. This will not be addressed as such in this chapter, but will be part of the empirical analysis in Chapters 3-6, and will be taken up again when proposing design requirements in Chapter 7.

Section 2.1 Dewey and Arendt on indeterminacy as a human condition

Dewey and Arendt are concerned with the question of how humans and society can develop adequate responses to the new and unexpected. What Dewey and Arendt also have in common is their aim to develop an engaged philosophy, that is, a thinking that is concerned with the everyday world, a world that is characterized by continuous change, ranging from people coming into the world (natality) and leaving it again (death), to the introduction, time and again, of novelties in existing orders and frameworks as a result of the activities of human beings. The world that humans

share is not pre-given, and there will be differences for different groups, nations and eras.[23] Existing interpretative frameworks (values, norms, roles, responsibilities, institutions) inherited from a different period are not necessarily adequate to grasp new realities, which can lead to indeterminate situations in which it is not clear what is happening, what is at stake, what to value, or which ends to pursue.

While Dewey uses the term 'indeterminacy', Arendt describes this situation in terms of 'the gap between past and future' (Arendt, 1993, p. 4, 5), 'the opening of an abyss of empty space (…) a kind of historical no man's land (…) that can be described as "no longer and not yet"' (Arendt, 1994, p. 158, 159). It is in such a situation that spaces for assembly can function as ways to articulate what is happening and to construct new or adapted interpretative frameworks through which an understanding of the new can be acquired. Such spaces are loci of a proactive public sphere, where addressing indeterminacies entails more than merely referring to the old order and the apparent security of its rules and frameworks.

Acquiring explicit understanding in relation to indeterminacies is not something that can occur in isolation, but only through interaction with others who also experience indeterminacy. Novelties are introduced into a world full of people who already at birth are situated and related to the world in different ways.

> *'To live together in the world means essentially that a world of things is between those who have it in common, as a table that is located between those who sit around it, the world, like every in-between, relates and separates men at the same time.'* (Arendt, 1998, p. 52)

This implies that people can never fully think, see or feel the same because they are situated differently and have different histories. Humans share a common world but often struggle over what it is that they share. It is exactly the common world that allows for disagreement and dissensus about what is going on, what is at stake and what should be done (Borren, 2009, p. 117). Human beings are conditioned and situated and are, from birth, already embedded in a network of material and

[23] Dewey and Arendt fit into a broader philosophical tradition that goes back to Aristotle, in which change, embeddedness, heterogeneity and contingency are taken as starting points in the development of ethical and political frameworks: for example, what does being human imply? How can we do justice to 'being human' in a changing society? The other philosophical tradition in Western societies is the Platonic tradition, with its search to find universal, fixed and monocausal truths. The fundamental difference between the two traditions has been emphasized by Toulmin (1976), who criticized the Platonic tradition, also in relation to science and society, and offered alternatives.

immaterial (that is, discursive) relations. The material and discursive environment influences which choices humans make as beings-in-the-world and what kind of opportunities they pursue.
See how Arendt describes the human condition:

> *'The human condition comprehends more than the conditions under which life has been given to man. Men are conditioned beings because everything they come into contact with turns immediately into a condition of their existence. The world (…) consists of things produced by human activities; but the things that owe their existence exclusively to men nevertheless constantly condition their human makers.'* (Arendt, 1998, p. 9)

Both Dewey and Arendt argue that the conditions in which humans find themselves do not determine their existence completely, but can be steered or modified, for example, by changing routines. When dedicated spaces for interaction are created that allow an inquiry into what is happening by participants sharing their perspectives, stakes and experiences, this is a step towards articulating goals and priorities and acting upon them. Mutual shaping between humans and their environment happens anyway, and is to some extent out of the hands of actors and their intentions. See how Dewey (1957) phrases this in *Human Nature and Conduct*:

> *'The object of foresight of consequences (this is part of a reflective inquiry, LK) is not to predict the future. It is to ascertain the meaning of present activities and to secure, so far as possible, a present activity with a unified meaning. We are not the creators of heaven and earth (…) Men always build better or worse than they know, for their acts are taken up into the broad sweep of events.'* (Dewey, 1957, p. 193)

Similarly, Arendt emphasizes that when you act, you do not know what you are unfolding. Your actions become part of the human web of affairs, where others act as well and which you cannot control.

Thus, for Dewey and Arendt, spaces for assembly are a way to acquire explicit understanding in relation to novelties and the entanglements that are created, and these spaces will make attempts to purposefully steer or modify what is happening more reflexive. For Dewey, spaces for assembly are a *sine qua non* for the good functioning of democratic societies, while Arendt sees them as a *sine qua non* for humans, as situated beings-in-the-world, to be 'at home' in a continually changing world. Dewey differentiates between 'stable' and 'indeterminate' situations, where in a stable world an individual is 'at home', in the sense that the world is consistent with its own preferences (Dewey, 2008a, p. 188). For Arendt, being at home is finding sense in what has happened or in what is

happening in the world.[24] Being at home in the world is always precarious and requires effort in interaction with others.

These considerations go further than the specific point about spaces for assembly. Democratic societies require a functioning public sphere, and Dewey and Arendt, each in their own way, offer indication of what such a public sphere should look like and what sort of interactions are important in the public sphere once one leaves universalistic approaches behind (for example, the approach of Habermas cf. Chapter 1). What I intended to show is that there is a resemblance between the situation that Dewey and Arendt describe, and that concerning the development and governance of nanotechnology with its characteristics of uncertainty, unpredictability, unknowns and heterogeneous groups of actors pushing and pulling in different directions. The indeterminacies in and around nanotechnology create openings for deliberation and negotiation, and when followed up, also new entanglements between nanotechnology developers, other stakeholders and civil society actors. Such processes around newly emerging science and technology were not explicitly considered by Dewey and Arendt, but some of their insights are still applicable, making it worthwhile to look more closely at their ideas.

Section 2.2 John Dewey

In Dewey's pragmatist philosophy, an important aim is to cultivate and expand the capacity of human beings to intelligently navigate a world in flux and to solve actual problems as these are experienced in everyday life.[25] In developing his philosophy, Dewey is concerned with the question of how to

[24] For Arendt, being 'at home' in the world also refers to having a certain measure of security, by having shelter and clothing and otherwise not depending on forces of nature. Security extends to protection by law, having the status of a citizen (which does not happen automatically, cf. Agamben (2005) on the 'state of exception' (as in the holocaust), and Varughese (2012) on citizens with and without a legal status participating in science and engaging in other kinds of interaction).

[25] For pragmatists, philosophy grows out of and is intrinsically connected with human affairs (Dewey, 1920, p. XI). Theories are seen as tools to intelligently navigate in a world in flux. When practice changes, theories should change as well in order to be able to guide people. Pragmatism developed three central theses formulated negatively as antifoundationalism, antidualism and antiscepticism (Keulartz et al., 2004). They can be read as criticisms of a focus of Western philosophy, since Plato, on finding universal, fixed and monocausal truths. As Keulartz et al. phrases it: "pragmatists reject every form of foundationalism and instead adhere to a distinct fallibilism (…) All our convictions, without exception, are of a provisional nature and are in principle susceptible to repeal or review" (Keulartz et al, 2004, p. 16). Pragmatists also reject essentialistic-dualistic thinking. Such a thinking does not serve problem-solving because it encourages black-and-white thinking while actual problems often are more complex, nuanced, context specific. According to pragmatists, fallibilism should not be equated with scepticism. In the words of Keulartz (2004), paraphrasing Peirce: "If absolute certainty is not

improve the relation between the interpretive frameworks of human beings, that is, their perspectives, values, institutions and beliefs, and a continually changing environment. The ideal relation would be that a human being is able to solve actual problems and modify their environment and thus not become a victim of change. New issues emerge at the junction of the old and the new. For example, novelties produced by science and technology developments can destabilize the 'harmony' between the interpretative frameworks of people and their actual experiences in daily life. Dewey argues that problems occur because interpretive frameworks do not develop at the same pace as new science and technology developments, or are in general unrelated to science and technology developments. Dewey considers his pragmatic philosophy to be a tool for humans to adapt in a productive way to a changing environment, and to solve problems.

In his time, Dewey was a dominating presence in the fields of political theory, philosophy and education (Shelley-Egan, 2011). However, his influence was eclipsed after the mid-twentieth century, when analytic philosophy became dominant in Anglo-Saxon academic philosophy. Within analytical philosophy, the emphasis is on logic and language analysis (Brown, 2009), and this is opposed to Dewey's philosophy as an approach intended to solve actual problems experienced in daily life.

As Shelley-Egan (2011) noted, Dewey's insights received renewed attention from social and political philosophers and philosophers of education from the 1980s onwards. This was initiated largely by Rorty (2003), who honoured Dewey as one of the three most important philosophers of the twentieth century. Within Science and Technology Studies (STS), there is now also increasing attention being paid to Dewey's experience- and experiment-based approach to ethics (see for example Keulartz et al. 2004; Shelley-Egan 2011) and to his call for bottom-up politics and decision-making (see for example Marres 2005).

In developing his philosophy, Dewey was strongly influenced by the circumstances in which he found himself – he lived in a period of rapid social, economic, demographic, political and technological change, part of the rise of urban-industrial society in the United States, or as Dewey called it, the rise of the 'machine age' (Dewey, 1927). He saw how new scientific and technological developments, such as public transport, the daily press and the radio destabilized existing ways of living and associating, while citizens were unable to interpret, value and judge these new developments because they inherited values, norms, routines, habits and institutions that stemmed from an earlier era. For example, with the further development of the telephone it became possible

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achievable due to a lack of metaphysical guarantees, this does not mean that people are left at the mercy of universal doubt (…) there is a world of difference between fallible knowledge and no knowledge at all. There is only more and less reliable knowledge" (Keulartz et al., 2004, p. 16).

for people to maintain relations at a distance without actually meeting each other. However, in everyday interpretative frameworks, small-scale communities and face-to-face contact remained the main point of reference. Thus, there were 'uneasy equilibriums' between the new daily realities of the urban-industrial era, and the interpretative frameworks of human beings (Dewey, 1920). Novelties made existing norms, values and routines less adequate, but new ones could not be developed because there was not the right 'equipment', in the sense of perspectives, values, norms and theories, to think and handle change, contingency and unpredictability. Specifically, traditional philosophy and ethics (such as Plato's 'quest for certainty' and the deontological ethics of Kant) were not adequate to serve as a guide for people living in the new industrial era to understand and assess the world around them.

The challenge for Dewey was to reconstruct philosophy – which he saw as a 'as set of beliefs and attitudes' – in such a way that it was able to think and handle change, contingency, heterogeneity and unpredictability. To realize this reconstruction, Dewey turned to the scientific-empirical methodology of observation, deliberation, hypothesizing and experimenting (Dewey, 1920, p. XXXIII). Since the late nineteenth century it had become accepted in science to see theories as fallible and thus always provisional. This could also be the case with regard to the interpretative frameworks, with human beings also perceiving their perspectives, values, beliefs and societal institutions as provisional and temporary, and sometimes in need of revision. In order to cultivate the capacity of human beings to do so and solve actual problems, Dewey developed his reflective inquiry approach (see Text box 1). Characteristic of reflective inquiry is that lived experience and communicative and cooperative inquiry are used as an approach to problem solving (Kadlec, 2007).

The experience of indeterminacy is an occasion to start a 'reflective inquiry', which subsequently leads to problem articulation and problem solving (Dewey, 1920). Rather than attempting to mould a problem into an already fixed pattern, one should inquire into the indeterminate situation and discover what the exact nature of the problem is: What are the issues? Who is involved? What is at stake? (Keulartz et al., 2004). The product of reflective inquiry is situated and temporary knowledge. Its value can be measured by whether it is able to solve actual problems, that is, whether it can 'effect a working connection between old habits, customs, institutions, beliefs and new conditions' (Dewey, 2008a, p. 137). Dewey is an optimist in the sense that he thinks that indeterminate situations can and will be recognized, and that the problematic issues that are articulated will ultimately be solved or mastered (Marres, 2007, p. 768). However, he does not really address the question of who decides – or who has the agency or authority to decide – when a problem is solved. As I will argue in Section 2.4, characteristic of the current governance situation for NEST is a difference in agency between nanotechnology developers and civil society actors. To

capture the full value of Dewey's reflective inquiry, the distribution of agency between different actors has to be taken into account.

Text box 1. Reflective inquiry as a way to inquire into indeterminate situations

A reflective inquiry consists of four successive phases (Dewey, 1938; Hildebrand, 2008). After the existential experience and recognition of an indeterminate situation, the first phase is to transform an indeterminate situation into a problematic situation by means of an inquiry into, and articulation of problems. Interactions take the form of sharing experiences, doubts and difficulties. Dewey emphasizes that problems do not exist prior to an inquiry. In judging that it is a problem, we judge how it is, we define it (Hildebrand, 2008). The second phase consists of formulating hypotheses about possible solutions to deal with the problems. Interactions take the form of forecasting, back casting, challenging standard repertoires and imagining the possible consequences of taking a particular line of action. The third phase is a rehearsal, in interaction, and the imagination of situations where possible solutions are addressed. In this phase, an estimate of possible consequences is made for those who are involved. The final phase of a reflective inquiry is the experimental testing (in real life) of the hypothesis that has emerged as the preferred solution. Dewey stresses that a solution should address as many issues as possible that were discovered during the process (Dewey, 1957). He emphasizes that a reflective inquiry should take the form of interaction and participation in the light of the unknown. What to value, how to act and which ends to pursue emerge through interaction. A reflective inquiry thus requires that participants dare and are willing to perceive their values, norms and ideas as contingent and provisional and search for and develop new ones (or adapt existing) ones in relation to new situations.

It is important to note that for Dewey the activity of reflective inquiry is not just a one-off affair, but a way of being a good citizen in a democracy. Dewey saw reflective inquiry as a way of cultivating the intelligence of people and society to actively guide the mutual shaping of humans and their surrounding environment through the cooperative investigation of problems and 'reappraisals of common goals and values' (Hildebrand, p. 45, 117). By 'intelligence', Dewey does not mean having a particular brain capacity, but to intelligence as a social activity, that is, the capacity to be sensitive to the consequences of actions and to evaluate whether or not the consequences are in need of reflective inquiry. A further point in Dewey's view of democracy is that when the consequences of acts only affect those who are directly engaged in the act or transaction it is a private affair (Dewey, 1927, p. 13) and the involvement of outsiders is not needed. If the consequences of acts 'extend

beyond those directly involved, and affect the welfare of many others, the act acquires a public capacity' (Dewey, 1927, p. 13). In other words, when those who were not involved in an act are affected by it in such a way that existing institutions and arrangements fail to address the consequences adequately and indeterminacy is experienced, then 'publics' (which is not similar to contemporary notions of 'civil society' or the 'general public') emerge. Dewey scholar Brown (Brown, 2009) argues that the term 'public' has an active as well as passive connotation for Dewey. Those who are indirectly affected form a 'passive protopublic'. The active element is that a public should organize itself and explore and reflect upon the consequences of an act and articulate problematic features by means of a reflective inquiry. Although Dewey never explicitly uses the term 'public spaces' (London, 2010), when citizens assemble to inquire into indeterminacy occasioned by consequences of actions, a public space emerges where new or adapted interpretative frameworks can be developed. Such public spaces are loci for public-sphere type interactions.

Whether something is a private or public affair cannot be determined a priori, but requires continuous inquiry into the consequences of actions. There will also be negotiation because people might disagree about whether or not consequences are extensive, far-reaching and enduring and thus in need of the involvement of those who were not involved in the act themselves. It is exactly this inquiry and the discovery of what are private and public affairs that is difficult in the 'machine age'. Science and technology have far-reaching consequences that in principle call many publics into being, but at the same time, science and technology developments increase the complexity, while acts and their consequences become entangled in such a way that citizens cannot gain an overview of what affects them, and thus cannot organize themselves in such a way that issues can be articulated and dealt with.

> *'Indirect, extensive, enduring and serious consequences of conjoint and interacting behavior call a public into existence having a common interest in controlling these consequences. But the machine age has so enormously expanded, multiplied, intensified and complicated the scope of the indirect consequences, have formed such immense and consolidated unions in action, on an impersonal rather than a community basis, that the resultant public cannot identify and distinguish itself.'* (Dewey, 1927)

Dewey scholar Marres (2005) argues that citizens in the machine age have difficulties in becoming an active public because acts have far-reaching consequences in space and in time. Those who are affected do not necessarily belong to the same social world, which makes it difficult for them

organize themselves.[26] They form a 'community of strangers', meaning that they are all implicated in an issue but do not belong to the same social world (Marres, 2005, p. 10). One can take this notion of a 'community of strangers' as one of the features of the public sphere in late-modern societies.

In *The Public and its Problems* (1927), Dewey asks the question of how citizens in a machine age can become an active public able to explore and reflect upon consequences of actions and articulate problematic issues. The same question can be raised about the current development of nanotechnology. Civil society is now expected to become involved and point out societal issues occasioned by the development of nanotechnology, so that these can be taken up (or not) by technology developers. The answer is not simple: present upstream engagement activities tend to remain superficial (Chapter 1). Here, Dewey's notion of 'officials', as representatives of public issues, is interesting because it is an alternative to the current way in which civil society organizations act and are expected to act.

Dewey does not assume the existence of a particular group of citizens out there that can be involved as such. The indirect consequences of actions call publics into being and there can be many publics at the same time, dealing with different consequences. Publics do not have a prior social, geographical or institutional status. Members of a public are related because they are all affected by the consequences of actions, albeit in different ways. They have a common interest in solving indeterminacy. Each member of a public has a particular lived experience of how consequences of an act affect their daily lives and what is at stake, and by sharing experiences, stakes and dilemmas in a reflective inquiry the nature of indeterminacy and its problematic issues can be discovered. A society dealing with novelties is a patchwork of publics that appear and then disappear when their business, that is, interactive reflective inquiry, has been concluded (Dewey, 2008b,10:23). One challenge is how passive protopublics become active publics. An important role for 'officials' can be found here as representatives of public interests (cf. Brown, 2009). As Dewey phrases it:

> *'Since those who are indirectly affected are not direct participants in the transactions in question, it is necessary that certain persons be set apart to represent them, and see to it that their interests are conserved and protected' (Dewey, 1927, p. 16)*

Officials as representatives of public issues are not formal representatives, as in versions of parliamentary democracy, but function in relation to indeterminate situations and publics: first there

[26] Dewey (1927) notes an additional problem: people in the machine age are oriented to consumption and exposed to a variety of entertainment. Direct satisfaction becomes more important than inquiry and the articulation of public affairs.

has to be a public, which then chooses persons to function as representatives for that particular public (Dewey, 1927, p. 24).

In Dewey's philosophy, representatives of public issues have a double role (cf. Brown 2009). The authority of a representative of public issues rests on their capacity to identify passive protopublics (and thus they have to recognize and articulate indeterminate situations) and at the same time their task is to ensure that issues identified are taken care of:

> *'Representatives partially construct the public they represent. They cannot simply mirror a pre-existing public will, because representation involves organizing and articulating the public itself' (Brown, 2009, p. 142).*

In addition, to address the issues, representatives must seek to promote those issues that publics articulate, through agenda setting and other ways to have them addressed by the state or other authoritative bodies. As soon as issues are dealt with these representatives disappear. Thus, Dewey had a bottom-up politics in mind, characterized by flexibility and temporal agreements. Assemblages of publics play an important role, and what is an appropriate configuration of and between publics in one context, or for one situation, might not be appropriate for another.

What might Dewey's work on publics and reflective inquiry have to offer for current challenges in Western societies to involve civil society as a new dialogue partner in newly emerging science and technology? Dewey has certain assumptions about functioning of societies that do not apply to the present situation. Marres (2005) already has pointed out that:

> *'Dewey assumed that there was, or should be, one state that would address the issues. However, we have the multiplicity of states to deal with.' (Marres, 2005, p. 11)*

Newly emerging science and technology is international and not limited in scope by nation-states, even if these play an important role. A simple example is the potential toxicity of engineered nanoparticles in products that are produced, distributed and used worldwide. Currently, guidelines for risk assessment and risk management of engineered nanoparticles are being developed at the national as well as at EU and international levels.

In Dewey's optimistic view, he assumes that every indeterminate situation will be recognized, and when problematic issues are articulated they will be settled, so no 'orphan issues' will remain. In my diagnosis of the present situation, I identified orphan issues such as the relative neglect of issues with regard to changing norms, values and responsibilities, compared with more tangible issues of the risks of new technologies (Swierstra & Rip, 2007). Nevertheless, Dewey's perspective on publics is

applicable here because it undermines the assumed legitimacy of the current distribution of roles and responsibilities between technology developers and 'civil society', visible in upstream engagement activities.

Section 2.3 Hannah Arendt

The overall thrust of Arendt's work was to rehabilitate the experience of politics as taking place in public spaces (Nieuwkerk & Van der Hoek, 1996). When Arendt speaks about the domain of politics she does not primarily refer to the government of a nation or the right of citizens to vote in a polity, but rather, inspired by the *agora* in ancient Greek city-states, she refers to an active engagement with the common world. For Arendt, engagement with the common world implies the interactive development of opinions, meanings, stories and judgments about what the common world actually is, how it is experienced by human beings – in the plural – as well as the experience of starting anew, for example, by breaking through routines. Such an engagement occurs through the activity of 'action'.[27] Arendt's work is concerned with the political-anthropological underpinnings of why action in public spaces is a necessary requirement ensuring the quality of human existence.

Her work has been taken up widely, particularly in the field of political theory and political philosophy, where her analysis of totalitarianism (see for example Canovan, 1977), her hermeneutic-philosophical approach (see for example Borren, 2009; Vasterling, 2011) and her thoughts on politics have received much critical appreciation (see for example Benhabib, 1996). Although Arendt was very much concerned with questions and issues that are also raised in the field of science and technology studies (STS), for example the autonomy of science in Western societies, the value of public involvement in science and technology developments, and the call for new collaborations between the natural sciences and the humanities, her work on these issues has not received much attention from STS scholars, even if there are a few authors who have analysed Arendt's thought on modern science and technology (Achterhuis, 1992; Drucker, 1998; Tijmes, 1992).

The development of her thought on the value of action and public spaces was strongly influenced by her experience of the Second World War and the phenomenon of totalitarianism (Arendt, 1973b), as well as the rise of mass society with its intensification of production and consumption (Arendt, 1998). In addition, there were new science and technology developments in

[27] For Arendt, the term 'action' has a special meaning (see below). If necessary, to avoid misunderstanding I will speak of 'the activity of action' to indicate Arendt's meaning of the term.

the twentieth century such as nuclear fission, the use of the atom bomb on Japan in 1945 and the threat of nuclear war, the launch of Sputnik and the first attempts to create life in a test tube (Arendt, 1998). What interested Arendt is that these latter events and changes introduced 'the new', 'the unexpected' into existing configurations and thus confronted our implicit understandings of the world. Arendt takes up this challenge by taking a hermeneutic-phenomenological approach to these new phenomena and attempts to generate an understanding of what these 'phenomena' mean for the human condition. In the prologue of *The Human Condition* (1998), Arendt describes her undertaking as follows:

> *'What I propose to (…) is a reconsideration of the human condition from the vantage point of our newest experiences and our most recent fears. (…) what I propose therefore is very simple: it is nothing more than to think what we are doing.'* (Arendt, 1998, p. 5)

For Arendt the Greek *agora,* situated in the physical constellation of a *polis,* served as a paradigmatic model of a public space in and through which people could generate explicit understanding in relation to novelties. The salient feature of novelties, Arendt argues, is that they cannot be understood in terms of existing vocabularies and evaluative frameworks. To acquire an explicit understanding of novelties without precedent, it is better not to start with familiar categories, but with the activity of action; i.e. 'to come together in speech and deed about worldly things, that is in debating, persuading, deciding on specific deeds (and doing them) about the common world that is in-between them' (Young-Bruehl, 2006, p. 83). 'Action', in Arendt's sense, is an anthropological category, in addition to the activities of labour and work. 'Labour' is to provide food and shelter so as to be able to survive. 'Work' is creating tools and artefacts more generally, and entails developing the skills to do so. 'Action' is where humans come into their own as relational beings in the world.[28]

[28] In Arendt's anthropology (1998), the activities of labour, work and action are connected to the human condition under which life is given to human beings. Labour corresponds with the human condition of life on earth, with the biological, cyclic processes of the human body such as breathing, sleeping and eating. Labour concerns the maintenance of the human organism and the human species. Work corresponds with the human condition of worldliness. Work is connected to the material, 'artificial' world of things, such as villages, institutions, nations, laws and technological artefacts. The world of things provides durability and permanence. Action corresponds to the human conditions of natality (that is, the capacity to start anew, to break through existing regimes) and plurality (the fact that men, not man, live in the world and inhabit the earth). Through the activity of action, one can acquire understanding of how the common world is perceived and experienced by men in the plural. According to Arendt, action is the only activity that can take place between humans (and not for or against them) and action requires the presence of others. Arendt emphasizes that action implies starting

For Arendt, action is not equivalent to exchanging information, or the freedom of expression. Action requires an effort of people to participate in public spaces: to perceive existing values, norms and perspectives as partial, contingent and temporal, and to explore and develop, in interaction with others and in relation to novelties, new or adapted perspectives. Action is an inquiry into entanglements and the imagining (making present to oneself) of how events and phenomena in the world might be experienced by others, who are situated in a different way towards the common world, and taking this into account when making decisions (Arendt, 1993, p. 214). Producing stories, that is, meaningful accounts, is a component, as well as an outcome of successful action in Arendt's political-anthropology. Stories do not reveal the truth but show how a situation is experienced from different perspectives and positions:

> *'A story lays open to view the complexity (…) the human multiplicity, interconnectedness and perspectival differentiation.'* (Disch, 1993, p. 667, 670)

Successful action can also be demonstrated when people act in concert (when word and deeds accompany each other). This can constitute tangible changes. The activity of action can occur in various ways and in various spaces, but there can also be dedicated spaces for action, as in the *agora* in Greek city-states, with rules about transparency and equality – in the sense of equal opportunity – which stimulate the activity of action. With the term 'equality' Arendt refers to the right of every participant to speak and to hear other perspectives on how the world and events in it are experienced.[29] It is not about everybody being the same. In fact, inequalities and differences become visible in public spaces, and they are articulated in these spaces. In Arendt's words: '[t]he equality attending the public realm is necessarily an equality of unequals who stand in need of being "equalized" in certain respects and for specific purposes' (Arendt, 1998, p. 215). Arendt did not study the experiences in the Greek *agora* out of mere historical interest, nor as an example that has to be followed literally. She was interested in illuminating the activity of action as it could take place in the *agora*, a space where people could assemble as equals (at the time, these were men). The value that Arendt attached to the *agora* and the types of interaction it allowed for concerned the provision of a

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something, setting things in motion (Arendt, 1998, p. 189). Thus, action entails a potentiality, a potential to establish new relations and acquire new understandings.

[29] In action, human beings show 'who' they are, as they reveal their uniqueness. Arendt contrasts this 'who' from 'what' a person is. A 'what-identity' is a collective identity which is shared with other persons, for example, belonging to a certain class, race, profession, religion or country. Disclosing 'who' you are entails action in a public space, it is a disclosure in relation to others with whom and for whom action is performed (Young-Bruehl, 2006, p. 86).

space where (new or adapted) intersubjective, interpretative frameworks of opinions, stories and judgments could be developed in relation to the new. In principle, these become part of a common, public world that functions as a 'collective resource' (Arendt, 1998). Interactions in public spaces in relation to the new are meant to unsettle discussion and to make present, by symmetrical deliberation, as many issues, values and perspectives as possible. For Arendt, politically relevant decision-making takes into account heterogeneity, complexity and ambiguity. I note that subsequently, there will be some reduction, or as I have called it, aggregation, to enable actual decision-making.

Arendt immediately adds that it is not the actual physical location that makes for a public space. Whenever people assemble, a public space emerges when they speak about their common world. In this sense, action and the formation of public spaces are mutually constitutive.

> *'It is the organization of the people as it arises out of acting and speaking together (…) and its true space lies between people living together for this purpose, no matter where they happen to be.'*
> (Arendt, 1998, p. 198)

It is the common world, the inherent in-between, that allows the establishment of a public space where new interpretative frameworks can be created in interaction. Certain institutional conditions can confer solidity and stimulate action, such as equality, transparency and the absence of totalitarianism. All this is conditional on there being margins for the activity of action, rather than being occupied all the time with work and labour in order to survive.[30]

Arendt's concept of action is important in broadening our ideas about interaction in public spaces as being more than merely deliberation and negotiation, by seeing existing arrangements and values as to some extent contingent, and by being willing to take risks in discussing new identities. This is already important with respect to ensuring that the involvement of civil society actors as new dialogue partners is more productive. The deeper, political-anthropological issue is that participants can act to realize their being human in the world. On both counts, the characteristics of action, in Arendt's sense, deserve to be part of public-sphere type interactions and be taken up in the design of good spaces.[31]

[30] This condition implies a certain organization of society, and perhaps also a certain level of technology that relieves the burden of labour. In the Greek city states, slave labour was an important condition for full citizens to be able to act (in Arendt's sense).

[31] It is in interaction that people shape their lives and show, and thus develop further, who they are. The activity of action refers to spontaneity, in the sense of doing something that you are not obliged to do, and indeterminacy, because the

Having said this, I should add that there is more to say about interactions in late modern societies. I mention two important points. First, while unsettling a discussion by making as many issues and stakes visible as possible is important to create openings so as to be able to consider the new without reducing it to the old, it is only a first step. To make decisions, some closure is also necessary. Indicative is that Arendt discusses the Greek *agora*, but not the *ekklesia*, where the actual decisions were made (Davenport and Leitch 2005, cf. Chapter 1). In this regard, it is important to discuss who will be involved in the reduction of complexity, and how. This is prefigured in interactions in dedicated spaces that allow some form of aggregation of the discussion, leading to outcomes that can be taken into account in eventual decision-making process.

Second, Arendt assumes that as people assemble they will start to question each other because they are interested in each other's viewpoints, values and activities, and that they will try to act in concert. Arendt may well have realized that this is an ideal. In practice, of course, people are selective about with whom they interact, and there are trade-offs involved in deciding whether or not to join a particular space for interaction. This has to be taken into account in designing good spaces for interaction in the real world. As I shall argue below, the experience of Constructive TA can be mobilized for this purpose (cf. Section 2.5). While Arendt recognized the diversity of perspectives and the struggles that are part of deliberation in public spaces, she did not consider what this could and should lead to.

Section 2.4 Dewey and Arendt and newly emerging technologies

Both Dewey and Arendt start from a situational and relational perspective on how humans are embedded in the world and relate to novelties, leading to indeterminate situations that have to

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responses of others are not predictable. In the activity of action, a person inserts themself into the common world by expressing ideas, experiences, values and dilemmas, to which others can respond, with some ideas, values and experiences becoming significant. In the activity of action, one becomes a public person, to whom others can relate. This is how Arendt fills in her relational concept of being human. A public sphere is then the medium for fully realizing one's humanity, not just a way to have society function democratically. Exclusion from participation in public spaces thus implies that people cannot fully realize their humanity . This is a complex point because humans may consciously choose to not participate in the public sphere, and be an *idiotes*, withdrawing into their own private sphere (cf. Lezaun & Soneryd 2006 on this Greek concept and present-day attempts at stimulating public participation). Arendt does not appear to accept this possibility as she argues that 'private man does not appear [to others], and therefore it is as though he did not exist. Whatever he does remains without significance and consequence to others' (Arendt , 1998, p. 58).

somehow be addressed. Spaces for assembly (Dewey) and public spaces in the form of an *agora* (Arendt) are key entrance points to addressing indeterminacies. If these are to be good spaces they must allow for public-sphere type interactions to deliberate about an indeterminate situation and they must provide an opportunity for those who are involved to gain insight into what is happening, as well as discover and articulate problematic issues that have to be taken into account in decision-making trajectories. Ambiguity and negotiation about what is happening and what should be done are inherent to reflective inquiry (Dewey) and agora-type interactions (Arendt). Indeterminate situations can only be partially resolved in these dedicated spaces. When participants leave the space, they go back to the wider world, the 'human web of affairs' (Arendt, 1998), with all its force fields, where other interactions will be played out. While these have their own dynamics, they can be anticipated in deliberations within dedicated spaces.

These considerations constitute general requirements for designing good spaces for interaction. Further requirements concern how dedicated spaces can contribute to a better, more reflexive, more intelligent functioning of our societies.[32] One consideration is that spaces for interaction are ideally not a one-off affair, but an inherent part of societies dealing with continually changing circumstances. Dewey's general idea of assemblages of publics that appear and disappear when the issues of concern have been addressed may not reflect what is happening in real life, but his related point about people being prepared to act as citizens, that is, to be involved in the public realm, remains important. To do so, competences have to be in place, for example, the capacity to recognize public issues.[33] Arendt's ideal of a well-functioning society builds on assemblages of self-regulating groups of citizens (Arendt, 1973a).[34] Whatever the ideal of a more reflexive and more intelligent society, in general and with respect to newly emerging science technology, one requirement for good spaces for interaction is that the deliberation conducted within it has effects in the real world. This is not just a matter of aggregation of articulated issues and stake into outcomes that can be disseminated and taken up by others. There is a further requirement, on institutions and

[32] Dewey (1957) speaks of '[having] more or less intelligent responses to changing circumstances'.

[33] Dewey wanted to develop these in citizen education for all (Dewey, 2008b).

[34] In her work *On Revolution* (1973), Arendt expresses her sympathy for grass-roots political participation of local citizens in wards, colonial townships or *Räte* (as these latter existed in Eastern Europe). Characteristic of wards, townships and *Räte* was that citizens could become a 'participator in government'. As Dana Vila (2000) argues, although Arendt is in favour of local political action, she cannot be grouped with proponents of 'direct' or 'radical' democracy because, due to her experience of totalitarianism, Arendt is in favour of 'worldly institutions and legal frameworks (…) that free citizens from external threat (...) These institutions and frameworks provide an arena for, but also limit political action and participation' (Vila, 2000, p. 14).

decision-making processes, to be open to what is articulated in the dedicated spaces and to be flexible enough to respond and take up the outcomes.

Recapitulating what was discussed in Chapter 1, there is an asymmetry in agency between civil society actors and actors developing and embedding science and technology in society. Civil society actors come in at a late stage, with little information (Rip & Robinson, 2013), and with little agency compared to technology developers. Also, technology developers can decide whether or not to take up the concerns, values and wishes of civil society in their decision-making processes. Moreover, there is a further asymmetry. Compared with Dewey and Arendt's emphasis on lived experience – either as a means to inquire into indeterminacies (Dewey) or to deliberate and negotiate about the common world that separates as well as relates human beings (Arendt) – nanotechnologies are still under construction so there are few if any lived experiences. The best one can do is to anticipate possible experiences, building on information about current developments. This, then, introduces another issue: Who provides such information, and from what perspective? This will be especially problematic if the provision of information occurs in the transmission mode of communication (cf. Chapter 1). In the transaction mode there will be interaction and the possibility of inquiring into underlying perspectives.

Here, we can usefully return to Dewey's ideas about publics and what he calls 'officials', as representatives of public issues. Dewey noted that in the machine age, the consequences of science and technology developments that have a public dimension are often not clearly seen by citizens, meaning that they do not realize what might affect them and do not organize themselves to articulate problematic issues. Dewey saw a role for what he called 'officials' to bring together all those who are involved and start a reflective inquiry. In a sense, officials would act as representatives of public issues, as civil society organizations claim to do, but in a more *ad hoc* manner – when the issue has been addressed, the 'official' will step back, unless another issue requires representation. Dewey's diagnosis that citizens in the machine age cannot gain an overview of what affects them is even more applicable at present with newly emerging science and technology, where diffuse promises abound and can only be met with diffuse concerns.

In *The Public and its Problems* (1927), Dewey emphasizes that the authority of 'officials' rests on their capacity to recognize and articulate indeterminate situations, and to identify passive proto-publics. It is not quite clear how this works in practice, but one entry point is to recognize that Constructive TA analysts and organizers of dedicated spaces for assembly (see further, Section 2.5) actually act as 'officials'. Social scientists or ethicists take up the role of mediators, bridging the separate worlds of technology developers and civil society by organizing dedicated bridging events based on a diagnosis of the present indeterminate situation (Robinson, 2010; Van Merkerk, 2007).

The role of 'official' is not just claimed, it is based on insights derived from his/her moving about within the various relevant worlds, observing, asking questions and analysing what is happening. Thus, she can see things and point out issues that are more difficult for other actors to see, as they are operating in a particular domain and focused on realizing their daily tasks and mandates.

CTA analysts are not the only example of Deweyan 'officials'. Policymakers or consultancies setting up upstream engagement activities are another, even while their situation introduces limitations to what they can do. Important for my analysis is that the projected role of civil society organizations as voices of civil society locates them as Deweyan 'officials'; see for example, how some CSOs position themselves, and are positioned by the European Commission,[35] as professional 'spokespersons' for public issues. However, there is also a difference to Deweyan 'officials'. CSOs such as Friends of the Earth, the ETC Group and Greenpeace are professional organizations that want to survive and need financial resources to do so as well as symbolic resources by being recognized as 'voices of civil society.' Thus, they must work with a business model that enables them to survive. However, it is not just a matter of surviving. In accumulating experiences and insights they also become better able to identify and address the relevant issues, and doing a better job than individual citizens could do by themselves. The other side of this coin is that their contribution will be shaped by their interests and avowed concerns, rather than the specifics of the issue. For example, in the UK, organizers of a public debate under the title *GM Nation?* held concerns about the predictability of the contributions of CSOs and therefore excluded them from the debate, looking instead for citizens with apparently no predetermined views (Lezaun & Soneryd, 2007).

If we start at the other end, with newly emerging science and technology as a topic for deliberation, rather than focusing on the role of certain actors as 'officials' , the challenge is that NEST lives to a large extent on promises. For example, nano-enabled devices that enable health care-at-a-distance can be discussed, but there are as yet no concrete issues. What sort of reflective inquiry is possible here? Parandian et al. (2012) emphasized how diffuse general promises also set concrete promise-requirement cycles in motion which enable and constrain how novelties materialize in

[35] See, for example, how an international coalition of CSOs position themselves as 'voices of civil society' for the promotion and protection of human rights
(www.responsibilitytoprotect.org...http://responsibilitytoprotect.org/Voices2012_final(1).pdf).
The European Commission positions CSOs as 'new and knowledgeable dialogue partners' in participatory policymaking processes, and research and innovation trajectories (Commission of the European Communities, 2001). CSOs are seen to be knowledgeable in giving voice to the concerns, issues and needs of citizens (2001:14). However, in the words of the European Commission once again: 'CSOs (...) as potential sources of knowledge, know-how and innovation (...) can contribute together with industry, science and policy, to a European knowledge-based society, one that is responsive to societal needs and concerns' (10).

society. Rather than focus on general promises and speculative futures, deliberation can address what is happening by using ongoing and new promise-requirement cycles. There might still be a division of labour, where civil society actors focus on the promises and their value, and technology developers on the technical trajectories, but the two would be linked as part of the same promise-requirement cycle. Because it will now be about concrete developments, the deliberation will be more focused than in the overall division of labour between 'promoters' and 'controllers' (see Chapter 1). One might actually see some co-construction of the trajectory and its embedding in society. I will return to such a possibility in Chapter 3. A further issue, and another starting point for deliberation, is that for a promise to materialize, certain requirements have to be in place, not just concerning technical performance, but also concerning embedding in society.[36] For example, to actually use body-area networks in health care at a distance, the sensors used should not only require low energy consumption (and/or use novel energy sources), but practical arrangements for telecare and new forms of patient behaviour are also necessary. In such a concrete vision of the future, those who are or might become affected can identify their possible roles and responsibilities and contribute to the deliberations on that basis. Rather than being labelled as outsiders (Garud & Ahlstrom, 1997; Rip & Shelley-Egan, 2010), in this broader picture they become insiders who have a right to speak and be heard. Phrased in this way, it is clear that orchestrated spaces for assembly that build on such an approach can enable action in Arendt's sense.

Section 2.5 The CTA approach: spaces to inquire into indeterminacies

In the previous section I have already drawn on the experience of Constructive TA to further articulate requirements for designing good spaces for interaction. In this section, I will briefly discuss the contribution of CTA in its own right, specifically when it creates purposefully designed spaces for interaction during the early stages of newly emerging science and technologies (Schot & Rip, 1997).[37] The CTA approach is compatible with Dewey's and Arendt's perspectives, in that it takes a situational and relational perspective on how different types of actors are embedded in society and relate to

[36] The identification of such requirements has been called 'fictive script' analysis (Den Boer et al., 2009). It can be used by officials like CTA analysts to identify stakes and who is to be involved in the deliberations.

[37] Two other TA approaches share CTA's focus on addressing technology development trajectories at an early stage and stimulating feedback into the design of new technologies and their embedding in society: real-time TA (Guston & Sarewtiz, 2002) and interactive TA (Grin & Van de Graaf, 1996). What CTA adds is a diagnosis of sociotechnical dynamics as a substantial part of the analysis and the shaping of soft interventions.

new science and technology developments and to each other. There is a background diagnosis, often formulated in terms of the co-evolution of science, technology and society and how the co-evolution can and should become more reflexive. A strongly institutionalized pattern in the co-evolution is the separation between the promotion and control of science and technology (cf. Chapter 1). This background diagnosis informs the development of concrete approaches and requirements for designing and orchestrating spaces for interaction (cf. Rip & Robinson, 2013).

Generally, in our differentiated society, actors (here, scientists, industrialists, funding bodies, policymakers, insurance companies and civil society actors) operate in relatively separate worlds, which makes it difficult for them to assemble and interact so as to take one another's activities, perspectives and values into account. Additionally, there is an asymmetry between technology developers and society at large, 'with the latter coming in at a late stage, and with little information about the technology' (Rip & Robinson, 2013). The objective of the CTA approach is to overcome such separations by creating 'bridging events' (Garud & Ahlstrom 1997). This shapes the design of spaces for interaction during the early stages of a technology development. It is a quite specific approach, but it is situated as part of an overall goal to create 'better technology in a better society' (Schot & Rip, 1997; Rip et al., 1995) 'while reducing the human cost of learning how to handle technology in society by trial-and-error' (Rip & Robinson, 2013; Rip, 2001).

There is an element of sociological enlightenment in the idea of making patterns and regimes in the co-evolution visible so that actors can better anticipate future developments and their impacts, and accommodate these insights in decision-making and implementation processes.[38] Thus, the aim of CTA is not just to improve reflexivity during deliberations in local spaces such as the CTA workshops, but there is also an interest in having such activities make a difference in terms of what actors decide and do once they have left the workshop and returned to their own institutions. While the topic of how to handle technology in society better is a political topic, it is not addressed through democratic parliamentary processes, but directly between relevant actors. Thus, it is an instance of what has been called 'subpolitics' by Beck (1997): political decision-making in spaces that are not marked as 'political' in representative parliamentary democracies.

While such larger questions are occasionally discussed, the focus of the CTA approach is on the design and orchestration of concrete spaces for assembly and interaction, 'microcosms' as Parandian (2012) called them. Groups of actors from separate but not independent worlds meet,

[38] The notion of 'sociological enlightenment' has been pushed by critical social theorists as important in overcoming naive modernism, with Zygmunt Bauman (2000) adding further arguments. Here, I use the term to refer to the importance of actors understanding the nature and dynamics of social order and integrating such an understanding into their action, but this resonates with the broader emancipatory use of the concept, which is part of the goal of Constructive TA.

and, in interaction, inquire into real world indeterminacies occasioned by the introduction of novel nanosciences and nanotechnologies. There may be some Deweyan reflective inquiry, particularly because an important part of the CTA approach is to make real-world indeterminacies visible with the help of sociotechnical scenarios.

Sociotechnical scenarios entail controlled speculation and they foreground multi-level, multi-actor dynamics (Robinson, 2010; Te Kulve, 2011). The creation of a sociotechnical scenario starts with a diagnosis of present uncertainties, knowledge gaps and ambiguities. The diagnosis is developed based on empirical data and insights obtained by the CTA analyst when moving in the different worlds. Different possible responses of actors to what is at stake in the diagnosis are envisaged, and the reactions and repercussions constitute a narrative about possible futures which make the consequences and meaning of present actions and reactions come alive. Thus, a sociotechnical scenario can be seen as reflective inquiry on paper.

A sociotechnical scenario fulfils a double role (Te Kulve, 2011). On the one hand, it creates an awareness of current developments and dynamics in particular innovation trajectories. Participants see themselves embedded in a broader development and the narrative shows how possible actions, interactions and repercussions might play out and lead to situations in which some paths can be more easily to pursued than others. On the other hand, in the actual space for deliberation, a scenario functions as a platform for actors to inquire into and articulate problematic issues that have to be taken into account (Te Kulve, 2011). Concretely, the moderator of the workshop can draw out issues that emerge in such a discussion, and participants are encouraged to think about strategies that can address problematic issues.

The CTA approach focuses on, and is thus biased towards, the developers and promoters of new sciences and technologies. As the slogan of the TA NanoNed programme encapsulates it: 'bridging the gap between innovation and ELSA', this bias is justified by its aim to effect changes at an early stage. Technology developers and promoters are thus the main target (Rip & Van Lente, 2013). Nevertheless, CTA does this through interactions between relevant actors, including civil society actors. This is also where the notion of 'probing each other's world' – close to Arendt's idea of action, in which actors reveal their identities and are prepared to modify them – comes in. Civil society actors who often have little or no direct knowledge of the situation are thus also enabled to speak more knowledgeably because of the sociotechnical scenarios that are provided and discussed.

At present, CTA has much to offer in terms of analysis and guidelines for designing spaces for assembly and interaction, and in terms of experience of what actually happens. Given its compatibility with the more general notions expressed by Dewey and Arendt, it would be interesting

to operationalize them and take them up in CTA-type workshops. This is actually what I have done in the research reported in Chapter 6.

Section 2.6 In conclusion

In this final section, I continue the discussion in Section 2.4 about what could be good spaces where NEST can be a topic for deliberation. I will collect the various elements of public-sphere type interactions discussed in this chapter and in Chapter 1, which will then be used to map and evaluate what occurs in the spaces I study in the empirical chapters.

A first consideration is that the 'goodness' of spaces is about more than actual interaction processes. The issues that are articulated have to become visible at collective levels, in discourses and documents, so that others can use them to anticipate and include societal issues in sociotechnical trajectories. For this to happen, there must be openings to do so at the level of institutions, and there must be affordances in society for nanotechnology developers and civil society actors to assemble, to the point of co-constructing innovation trajectories. Good spaces for assembly are ideally not one-off affairs but part of an overall move in society to become more reflexive about new science and technology and develop more intelligent responses to address indeterminacies. Spaces for assembly should contribute to societal learning and articulation processes. In the cases presented in this thesis this should occur in relation to the development and governance of newly emerging nanotechnology. These spaces are always part of multi-level, multi-actor configurations, and this has implications for their design. One such implication is for participants to become more aware of how they are part of these multi-level, multi-actor configurations which enable and constrain their activities.

This leads to a second consideration: in the microcosm of a space for assembly such configurations will become visible when participants share their considerations and probe each other's worlds – which would include the activity of action in Arendt's sense, that is, risking oneself. In addition to identifying issues in relation to the indeterminate situation, there should be some Deweyan reflective inquiry, where participants develop and rehearse new or more adapted interpretive frameworks on how to address these issues. Spaces for assembly should therefore allow for some distance from immediate action, so that possible futures and their implications can be explored and assessed.

A third consideration starts with the diagnosis of an indeterminate situation concerning nanotechnology. This is a challenge that has to be addressed through inquiry. At the same time, for

actors to invest in such an inquiry, there must be something at stake for them, even if this is still unclear because of the indeterminacies. Dewey recognized this quandary when he proposed the role of the 'official', who actively identifies issues and brings about assembly. In practice, at least in the cases studied here, there will also be a top-down element, as when the European Commission or a committee organizing a societal dialogue invites proposals to organize interaction and competence building. A CTA analyst can take the initiative based on the diagnosis of existing 'insider-outsider' interaction patterns which have to be overcome. The relative success of the CTA approach (Rip &Robinson, 2013) shows that 'officials' can indeed play an important orchestrating role by identifying issues and actors relevant to the space for assembly, and by stimulating interaction processes.

The fourth and final consideration concerns the role of public-sphere type interactions in making heterogeneity and complexity visible, in line with both Arendt's and Dewey's ideas of making visible as many issues and stakes as possible. As commented in Section 2.3, the interactions should also include the aggregation of the deliberations into outcomes that can be taken up elsewhere, by both participants and others. Thus, some reduction of complexity is also necessary.

These four considerations, together with the earlier discussion of requirements for good spaces in Chapter 1 and in Section 2.4, add up to tentative guidelines for the design and orchestration of spaces for assembly and interaction. Only some of the approaches contained in these guidelines will be visible in the empirical cases, allowing for some evaluation of their effects, particularly on the nature and extent of the public-sphere type interactions that occur.

Another result of my analysis in this chapter is an improved list of public-sphere type interactions that might occur in the spaces for assembly that will be studied empirically. The Table below summarizes these. This Table will be used in the following empirical chapters to trace which types of interactions actually occurred in the particular space for assembly. The Table is organized into three main categories, 'deliberation', 'negotiation' and 'aggregation' (see Chapter 1, and Rip &Joly 2004, 2012 on spaces). Separately, 'assembling', is included. This is not a public-sphere type interaction, even if it is integral to the space for assembly.

Of course, such categorizing of the interaction processes in terms of a list of public-sphere type interactions reduces complexity. 'Public-sphere type interaction' is a theoretical construct, and as I noted in Chapter 1, may have to evolve further through reflection on empirical findings. Nevertheless, it is important to work with a theoretical list which is temporarily fixed, in order to map the outcomes of the design conditions and consider causal relations between such conditions and outcomes. Such understanding, even if only provisional, will help to better design good spaces.

Table 1 List of public-sphere type interactions

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.
	Public-sphere type interactions
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.
Articulation	Articulation of emerging common, (public) issues
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes

While this list has a value in its own right, being based on experience, as well as critical discussion in the literature on public involvement and my mobilization of insights from Dewey and Arendt, it is open to modification and improvement based on further experience and reflection. I will return to this in the concluding chapter.

The items in the list are formulated in terms of referring to what happens in dedicated spaces, but they are also features of the public sphere more generally as it attempts to encompass

newly emerging science and technology in its deliberations. Thus, it is a stepping stone to considering a possible extension of the public sphere, to which I will return in Chapter 7, Section 7.2.

Chapter 3 Challenges for co-construction projects between industry and CSOs

The partnership between chemical company DuPont and Environmental Defense Fund

Introduction

Developers and promoters of newly emerging science and technology and civil society organizations (CSOs) traditionally operate quite separately regarding the development of a new technology: developers realize a new technology and CSOs only become active when products enter the market, addressing government agencies or choosing direct action, for example, protest and/or media attention. Thus, the three-year partnership between DuPont and Environmental Defense Fund (EDF) set up in 2006 with the aim of co-constructing a risk framework for the development, use and disposal of engineered nanoscale materials (DuPont & Environmental Defense Fund) is an interesting new venture. It is also interesting to study this partnership in terms of public-sphere type interactions. First, because both actors interpreted the partnership as focused on addressing an indeterminate situation, where the question is if and how engineered nanoscale materials might pose health and environmental problems to society at large. Second, because the two actors had to come to agreements about what should be in the risk framework, there would be interaction processes. Consequently, I can analyse how far public-sphere type interactions occurred and what were the enabling and constraining conditions. An additional reason for examining this partnership, was that it provided an opportunity to study the repercussions that such a co-construction project between a firm and a CSO provoke in our society: when DuPont and EDF launched the final risk framework in the wider world, both the framework and the partnership encountered appraisal as well as critique, including rejection.

There is an increasing number of collaborations between companies and civil society organizations.[39] As noted in Chapter 1, public engagement is sought after, but there is also criticism.

[39] Increasing interaction, including collaborations, between firms and CSOs in the development and governance of newly emerging science and technology are part of a broader dynamic in our society, in which civil society organizations are positioned as new dialogue partners in research and innovation trajectories (cf. European Commission, 2005-2006) (see further Chapter 4). Companies are also positioning CSOs as new dialogue partners in relation to their efforts in the field of

A critique that is articulated by CSOs and public engagement scholars (Hanssen, 2009; Powell, 2008) in relation to public participation in newly emerging science and technology, is that interaction events are often symbolic exercises, implying that there is not much at stake for technology developers other than providing information and that results of such events do not have an impact on decision-making processes. Some co-construction projects might themselves turn out to be merely symbolic exercises. Despite this concern, it is interesting to learn that within the development of newly emerging science and technology dedicated spaces for interaction, such as co-construction projects between firms and CSOs, are being created that have the explicit aim of influencing decision-making processes. For example, between 1994 and 2001, Unilever and non-governmental environmental and consumer organizations in the UK established a long-term interaction forum called Contact Group to deliberate about the commercialization of GM food (Doubleday, 2004). The Contact Group was created due to societal controversies in the UK with regard to the desirability and safety of GM food. These controversies 'presented Unilever with a significant challenge to its commercial strategy' (Doubleday, 2004, p. 119). The explicit aim of the Contact Group was to overcome the traditional division of labour between industry and consumers, and in interaction, develop new or adapted vocabularies and ways to understand industry-consumer relations, in particular with regard to the development, regulation and commercialization of GM food (Doubleday, 2004, p. 118). The kinds of questions that were raised in the Contact Group were: What kind of life do I want to live? Can GM food be part of this? What is the responsibility of a producer?

Another example of a project that was explicitly called a co-construction was the collaboration between biotechnology developers at INRA[40] and a local stakeholder monitoring committee called Comité de Suivi concerning field trials with GM vines in the Alsace. There had been public controversy in France about GM organisms and in this context field trials with GM vines also had the potential to be highly controversial (Marris et al., 2008). As a result, INRA, which was responsible for the GM field trials, decided to undertake an Interactive TA exercise to include input from broader stakeholders in the decision-making processes which would determine whether and how field trials of GM vines would occur. One result was recognition of the need to create a local monitoring committee. Local NGOs such as the Alsace Consumer Association participated in the monitoring committee, as well as the professional winegrowing association of Alsace, a neighbour of the trial site and the Agricultural and Viticultural Training School. During the monitoring of the setup

Corporate Social Responsibility and activities designed to increase their environmental and societal performance (for concrete examples, see Laasonen, 2012).

[40] INRA is the acronym for the French Institut National de la Recherche Agronomique.

of the project, a joint effort to develop a good research design for the development and implementation of the field tests emerged (The Local Monitoring Committee, Lemaire, Moneyron, & Masson, 2010).

Within the development and governance of newly emerging nanosciences and nanotechnologies, there have been a few co-construction projects apart from the bilateral partnership between DuPont and EDF. However, unlike biotechnology collaborations between firms and CSOs which began as a response to existing societal controversies, nanotechnology collaborations between firms and CSOs have been established proactively to anticipate possible problems and controversies. Objectives that currently figure in these collaborations are: 'do it right from the beginning'; 'reap the benefits and manage the risks'; 'create a responsible development and innovation' and 'create trust, transparency and a climate of openness'. Laurent (2011) describes a co-construction project between industry, policymakers and consumer and environmental organizations aimed at developing a 'nano-responsible standard' that would help firms with regard to decision-making in a context of uncertainty about the potential risks and benefits of nano-substances and products. At the same time the standard should function as a tool for concerned groups to gain information about industrial processes and consumer goods.

A further example of co-construction, which occurred in 2009 and 2010, is the DialogForum Nano organized by the chemical company BASF. The aim of the DialogForum was to provide civil society organizations (environmental and consumer groups, as well as church groups) with a platform to inquire with BASF into how to develop more communication and transparency throughout the product life cycle of nanomaterials. Concrete proposals were put in writing (Grobe, et al., 2010).

Co-construction projects can provoke different reactions. In the biotech co-construction project undertaken by Unilever and environmental and consumer groups in the UK, the partnership changed when the results of the Contact Group were considered in the broader context of Unilever as a multinational organization. The requirements the Contact Group developed with regard to establishing new industry-consumer relations were UK specific, while Unilever is a global company. In order to institutionalize the results, Unilever aimed to create a general definition of new industry-consumer relations that would be applicable worldwide. For this purpose, the recommendations of the Contact Group were only partially considered by the management of Unilever, resulting in tensions with NGO members that had participated in the UK Contact Group (Doubleday, 2004, p. 123, 124). Moreover, in INRA's co-construction project for field tests of GM vines, participants linked to NGOs became uneasy when their contribution to the Comité de Suivi was praised by government ministries as an example of how NGOS could collaborate. Their concern was that the NGOs to which they were linked would now be seen as co-opted by INRA. As a result, the participants linked to

NGOs became reluctant to be seen as actively involved with the Comité de Suivi (Rip, 2012b). Ambivalences of the INRA co-construction project became particularly visible in August 2010 when an activist group (not part of the Comité de Suivi) destroyed the field tests.[41]

An interesting feature of the partnership between DuPont and EDF, as will become apparent in this chapter, is how the launch of the framework in the wider world pushed chemical industry and an international coalition of civil society organizations to articulate what they saw as appropriate roles and responsibilities of industry and CSOs in addressing challenges of newly emerging nanotechnology.

Structure of the chapter

This chapter will describe the activities that took place at different levels but with a specific focus on the interactions that occurred in the local space for interaction. The content of the risk framework that was established will not be addressed – more information on the content can be found at www.nanoriskframework.com and in Bowman (Bowman & Hodge, 2008). The chapter will consider three questions: 1) if and how far public-sphere type interactions were realized in the local space for interaction: How did DuPont and EDF position themselves and each other? What were their expectations for the partnership, and of each other's contribution to it? 2) In addition, I will also discuss how the partnership between a chemical company and CSO during the early stages of the development of nanotechnology was perceived by other chemical companies and CSOs and 3) if and how outcomes of this space for assembly became publicly visible in discourses and documents, so that other actors, in other contexts, could, in principle, take the outcomes into consideration.

Data collection

Data on interaction processes were collected after the partnership was formally terminated. I conducted a telephone interview with one of the project leaders of EDF, Gwen Ruta (Vice President of corporate partnerships), in 2009, as well as a face-to-face interview with the project leader of DuPont, Terry Medley, and a face-to-face group interview with DuPont project members in the

[41] For further details and complexities see Arie Rip: 'Tools for analysis of, and reflection on, controversies: Illustrated by the Colmar GM field test trajectory and more generally, the dialogue between science and society. Course text, Master's Course 'Espaces, Ressources, Milieux', AgroParis Tech, 7 March 2012.

United States. To complement the data from the interviews, a video conference that had been organized (www.nanotechproject.org/events/archive/environmental_defense_dupont_to_jointly/) and documents from EDF and DuPont about the partnership, as found on their websites, were also analysed.[42] To gain insight into the enabling and constraining conditions at the collective level of chemical industry and CSOs with regard to the establishment of co-construction projects, I studied position papers by CSOs and Codes of Conduct developed by chemical industry. In addition, to find out about how the partnership was perceived by chemical industry, interviews were conducted with three representatives of chemical companies – Evonik (Degussa), the association of manufacturers and importers of cosmetics, and a Dutch chemical company. To gain insight in how CSOs perceived the partnership, I studied a position paper written by an international coalition of CSOs in response to the launch of the risk framework. I also participated in two international CSO meetings in which CSOs articulated roles and responsibilities in relation to the development and governance of newly emerging technologies.[43] Between 2008 and 2011, I had the opportunity to be present as an observer on the Dutch Sounding Board on Risks of Nanotechnology. Members of the Sounding Board (which is still running) include chemical companies, the Confederation of Netherlands Industry and Employers (VNO-NCW), CSOs (environmental groups and a consumer organization), and policymakers from several Dutch government agencies. Here it was possible to observe how companies and CSOs articulate their roles and responsibilities in relation to each other and in relation to the challenges of the development of newly emerging nanosciences and nanotechnologies.

The consent of the interviewees was obtained for all the quotes from the interviews. The interpretation of these quotes is mine.

[42] See www.edf.org; http://www2.dupont.com/media/en-us/news-events/insights/nanotechnology.html; and www.nanoriskframework.com.

[43] In 2008 I participated in a meeting organized by the Netherlands Society for Nature and Environment (www.snm.nl), in which national and international non-governmental environmental organizations discussed roles and responsibilities in relation to new and emerging nanotechnology. In the same year, I also participated in an international CSO meeting in Bonn (www.planet-diversity.org). As part of this conference, CSOs organized workshops on synthetic biology, GMOs and nanotechnology in relation to the future of food and agriculture.

Section 3.1 Establishing a partnership

In 2004, EDF, a non-governmental organization, founded in 1967 by a small group of scientists and now representing more than 750,000 members (www.edf.org/about/our-mission-and-history), approached DuPont with the invitation to establish a partnership to develop a joint risk management methodology for identifying and assessing risk and safety issues in relation to engineered nanoscale materials. The aim was to develop a framework that could be widely used by other companies and stakeholders. EDF considered such a framework to be important because nanotechnology has the potential to deliver environmental benefits such as cleaner energy production and environmental remediation, but as they say on their website (www.edf.org), there is 'a lack of understanding of which specific properties will determine or are otherwise relevant to nanomaterials' risk potential'. EDF also notes that it is also not clear whether existing knowledge about and processes for registering conventional chemicals (e.g., in REACH and TSCA)[44] is sufficient for nanoscale materials. EDF suggested that as long as government action to develop new or adapted regulation is absent, industry itself should develop risk assessment methodologies in order to 'reap the benefits and manage the risks of nanotechnology' (www.edf.org).

EDF has a long tradition of corporate partnerships. This is due to their strong belief in the power of the marketplace. One of their aims is to find intersections between environmental benefits and business benefits. Characteristic of the EDF business model is 'finding ways that work', which basically means that they are interested in the results, that is, with the environmental endpoints they want to achieve (see www.edf.org). For each situation, they figure out how to get there. Corporate partnerships are one way, besides policy advocacy in government and direct action. The Vice-President of Corporate Partnership at EDF considered corporate partnerships sufficient with respect to nanotechnology because:

> *'the risks of nanotechnology is a place where environmental goals and business goals can overlap'* (interview EDF, 2009)

EDF's business model for corporate partnerships explicitly states that the goal is not just to stimulate change within one company but, as the Vice-President of EDF also stated:

[44] REACH is the European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorization and Restriction of Chemical Substances. TSCA is the US Toxic Substances Control Act, for which the Environmental Protection Agency (EPA) has responsibility.

'what we try to do is show best practices that really transform that entire industry sector' (interview EDF, 2009)

This is why EDF chose to collaborate with a company:

'That worked with nanotechnology very broadly across the sector, not narrowly, say for example with one nanoparticle (…) and we wanted a company that was highly visible in the chemical sector because we wanted other companies to pay attention to what we did.' (interview EDF, 2009)

An additional reason to approach DuPont was the fact that EDF and DuPont already shared a history of collaboration in other areas, starting in the 1980s. Known for being at the forefront of developing new risk management procedures, by the time Dupont received the invitation from EDF to collaborate they were already participating in ICON, a multistakeholder organization that includes CSOs, focused on issues of responsible nanotechnology (www.icon.rice.edu).[45] As one of the DuPont project members recalled during the group interview, for DuPont it was not immediately evident what a partnership with EDF could add to the deliberations they already engaged in with ICON. According to DuPont staff, adequate knowledge about nanosciences is a prerequisite to inquire into indeterminacies regarding health and environmental safety issues, and they doubted whether a non-governmental environmental group could possess such knowledge. What occurred was the establishment of a pre-project phase, or in the words of a DuPont project member, a 'period of courtship'. This pre-project phase consisted of vision meetings in which both parties shared their ideas, values and perspectives on the intended partnership and what should be included in the risk framework. As became clear in the interviews with DuPont, this courtship period proved important to the eventual productivity of co-constructing a risk framework because the initial preconceived notion of NGOs as uninformed dialogue partners turned out to be unfounded. As one of the DuPont project members said in an email conversation with me (22-09-2009):

'I had the initial expectation that they (EDF) would have a position/bias that was more political than 'scientifically' based, (…) my opinion changed early on as I found these colleagues to be more scientific-based and their arguments more substantive – than I had originally expected.'

[45] The main concern for ICON is the 'potential environmental and health risks of nanotechnology, thereby fostering risk reduction while maximizing societal benefit' (www.icon.rice.edu). Representatives of large and small corporations, government agencies, academic institutions and non-governmental groups from around the world participate in ICON. More details on the establishment of ICON can be found at www.icon.rice.edu and in McCarty & Kelty (2010).

DuPont staff found the invitation by EDF to co-construct a risk framework both challenging and new. During the interview they stated that they had previously had interactions with NGOs, for example consumer groups, downstream in the innovation trajectory when products enter the market, because, as the project leader of DuPont articulated:

> *'You want to get information about what are important issues.'*

In contrast, the co-construction of a risk methodology for which there were as yet no best practices, with a partner who had different mandates and responsibilities, was considered new and challenging.

An important circumstance that made DuPont accept the invitation were the lessons they had learnt from the introduction of biotechnology in society. In a video conference about the partnership, Vice-President of DuPont and Chief Sustainability Officer Linda Fisher said:

> *'There was insufficient interaction between industry and NGOs during biotechnology, that really plagued the acceptance of that technology (…) now we have a chance 'to do it right from the beginning'.*

In a joint article written for the *Wall Street Journal* by the CEO of DuPont and the president of EDF to introduce the partnership, the authors also made reference to mistakes that were made in the development and introduction of earlier new technologies (Krupp & Holliday, 2005):

> *'Too little research on risk assessment and too little communication during the early stages, led to unintended consequences of amongst others DDT and leaded gasoline (…) Now we have a chance 'to do it right from the beginning.'*

In this same article, the co-construction of the risk framework is positioned as:

> *'(...) not just good common sense, it's good business strategy.'*

In the same year that EDF invited DuPont to collaborate, reinsurance company SwissRe urged companies 'to waste no time in assessing the risks and benefits' (Hett, 2005). During the interview at DuPont, the project leader observed that in nanotechnology there is momentum towards increasing

collaborations between industry and NGOs, while in biotechnology, the positions of different stakeholders were divergent:

> *'For nanoscale science and engineering, there is a general agreement across a broad spectrum of stakeholders about the potential value and benefit to be derived from the technology in multiple areas.'*

Section 3.2 Interaction processes during the partnership

Before the project officially started, both parties signed a non-disclosure agreement, implying that everything that was to be said and done during the collaboration should be kept between the two parties unless both parties decide otherwise. DuPont's production processes for nanoscale materials were taken as a source for the joint inquiry into and articulation of what could be at stake with regard to health and environmental safety issues. As a DuPont member explained, the aim of using information from actual production processes was that:

> *'We had to have some real things to build on, otherwise it would become too abstract.'*

To have access to information about the production processes, EDF had to promise secrecy.
To stimulate an inquiry into the development, use and disposal of engineered nanoscale materials, small project groups were established, for example, dealing with ecological concerns, workplace safety and human health concerns. Members of DuPont and EDF participated in each project group, with the aim of reaching a consensus about what was at stake and should be included in the risk framework. As a DuPont project member articulated:

> *'About the structure of the framework (…) it was more an iterative engagement of both sides. We each came in with a model at the start (...) and in the end it became a group perspective.'*

There was face-to-face deliberation, deliberation via email and conference calls, as well as a joint trip to a farm owned by DuPont every now and then, where the project members of DuPont and EDF could 'work and play together'. The idea behind these trips was that such an informal setting would contribute a better understanding of each other's positions, views and values.

The fact that DuPont and EDF had agreed to collaborate stimulated interactivity. DuPont staff and the project leader of EDF pointed out that there were differences of opinion between the partners on some issues, but nevertheless, as a DuPont staff member recalled:

> *'We had a 360 degree outlook (…) we kept spinning around and everybody would look at it from their perspective.'*

Topics on which agreement could not be reached were mentioned as such in the framework. Thus, the individual perspectives of DuPont and EDF remained visible in the text of the framework.[46] The project leader of DuPont explained this decision as follows:

> *'The key for our discussion was that we wanted to make the best informed decisions. So you need all the different perspectives (…) the differences were what made the project robust and comprehensive.'*

For DuPont, the collaboration with EDF was more than a symbolic exercise. The nano risk framework became part of their mandatory product stewardship process, and based on the outcomes of a pilot during the partnership, DuPont decided to postpone the further development of a particular nanoscale material (that of Zero Valent Nano Sized Iron Nanoparticles [nZVI] for Environmental Remediation).
A further effect was reconsideration of the views of each partner about the other. This was particularly striking for Dupont. As a DuPont project member said:

> *'Well personally, it gave me the understanding that there are more science-based NGOs out there, and that as a scientist, one can develop science-based partnerships. That was novel to me.'*

This was linked to a general sense of learning throughout the partnership. As the project leader of DuPont articulated:

> *'What the partnership did from the standpoint of behaviour changes (…) really realizing, that for this technology, you do want people working together at the table rather than having people polarize, having different views (…)'*

[46] Note how this might be an example of a successful outcome of a reflective inquiry in the twenty-first century, first proposed by Dewey. As we saw in Chapter 2, a reflective inquiry is considered successful when solutions are developed (which will always be flexible and temporary) that take into account as many of the problematic issues discovered during the interactions as possible.

A DuPont project member continues:

> *'There was shared learning as we went into this (…) at the end of this exercise we understood the space (nanoscience and engineering) a whole lot better than when we started.'*

In fact, during the group interview, DuPont project members said that they were open to more collaborations with CSOs, with EDF, but also Greenpeace was mentioned as a possible dialogue partner, for example in relation to issues of sustainability and energy efficiency. DuPont staff did add that a requirement for such collaboration is that CSOs 'leave the politics outside' and 'come in objectively'. When newly emerging science and technology is the topic for deliberation, an additional requirement was that CSOs should 'understand the science and the balance between technology innovation and stewardship'.

Consultation processes with the 'wider world'

DuPont and EDF extended their inquiry through closed peer review, and both reached out confidentially to colleagues (in this case chemical companies, CSOs, labour unions and regulatory agencies) who they knew had specific expertise. Towards the end of the partnership, they also reserved a period of time for online comments on the draft framework because they wanted to be 'open to the possibility that somebody else in the world had a better idea', as the project leader of EDF explained. During this consultation phase, DuPont and EDF received comments concerning what some thought was a rather narrow focus of the risk framework: other societal issues, such as social equity, privacy and economic development, were not addressed. DuPont and EDF noted that they considered these issues important for the broader nanotechnology dialogue, but, as they articulated, given their expertise their focus was on environmental, health and safety risks (DuPont & Environmental Defense Fund, p. 12) They urge other stakeholders to discuss these broader societal issues. The project leader of DuPont went a step further, equating responsible development of nanotechnology primarily with health, environment and safety issues:

> *'The commitment was trying to identify a systematic and disciplined way of addressing responsible development. If that is your objective, then you are looking at risk management, risk assessment, the science.'*

This reflects a general trend to foreground risk assessment, which is assumed to be 'hard' (quantifiable, tangible objective), compared to the 'soft' impacts (related to broader ethical and societal issues, for example, the mutual shaping of technology and morality, which are perceived as less tangible and subjective) (Swierstra & Te Molder, 2012).

Section 3.3 The wider world: reactions at the collective level

What is productive in a dedicated, protected space for interaction, may encounter comments, up to critique, resistance and rejection in the wider world. When DuPont and EDF made the final risk framework public, both the framework and the partnership attracted praise and criticism, and some even rejected it.

In general, the chemical sector welcomed the risk framework. The development of a voluntary, non-legally binding risk framework fitted with the Responsible Care Program® of the chemical industry (www.cefic.org/Responsible-Care/). Chemical companies such as Bayer, Evonik/Degussa and the umbrella organization Cefic had also developed such soft regulation proposals for the responsible development of nanotechnology, for example in the form of Codes of Conduct (Bowman & Hodge, 2008).[47]

A former employee of Evonik/Degussa offered a nuanced perspective on the issue in an email conversation (6-10-10):

> *'The EDF-DuPont framework struck many industrial colleagues as being obvious. It is a solid re-write of what is expected from any firm when submitting a PMN (pre-manufacturing notification, which is how one registers a chemical onto TSCA) (…) Some of us in industry would have wished to be involved, but there was no invitation to join during the deliberations. There was an opportunity to comment on the finished document (…) but I felt that commenting is a form of legitimizing rather than a genuine opportunity for input. Though I see areas for improvement and though I agree that there is not much new in the nano-risk framework, I must also accept that no one has ever put together such a detailed 'how to do it right' document for the 30 years that TSCA has been around. The colleagues at EDF and DuPont did the right thing and deserve great credit from all for their contribution.'*

[47] As Reichow and Dorbeck-Jung argue (2013) based on Senden (2004), soft regulation refers to rules of conduct which do not have a legally binding force, but which nevertheless have regulatory force in regulating practice.

Having a CSO as a dialogue partner during the early stages of the development of newly emerging science and technology, is unusual in the chemical industry. Companies like Evonik/Degussa are receptive to early stage interactions with CSOs, but not just any CSO (Shelley-Egan, 2011). EDF is considered as highly knowledgeable and trustworthy by members of industry. As a spokesperson for a Dutch chemical firm formulated it:

> *'We would like to have such a partnership, but in the Netherlands, CSOs are not that knowledgeable'.*

We see elements of a broader pattern here. As Shelley-Egan (2011) noted, a discourse is emerging within the chemical industry, in which companies differentiate between 'good' and 'bad' NGOs. Good NGOs know about the science involved and are trustworthy (for example, the DuPont staff considered 'knowing the science' to be a requirement for collaboration). For companies, 'being trustworthy' also implies that CSOs show commitment, meaning that they should not (at least not without notice) conduct activities with different orientations in parallel to their involvement in interaction forums with industry.[48] NGOs may well see this differently. In contrast, 'bad NGOs' ('bad' according to members of the industry) are those who do not make the effort to inform themselves with adequate information, but only want to hear those things that affirm their own points of view.[49]

The risk framework, as a form of soft regulation, as well as the partnership between a chemical company and environmental NGO, encountered criticism from and rejection by other civil

[48] Industry members of the German NanoKommission were angry with Friends of the Earth for giving a press conference about their report on nanotechnology in food and agriculture without informing them beforehand (Rip & Joly, 2012). From the CSO side, such a concern is unnecessarily constraining and patronizing. This issue was addressed explicitly in the Dutch Sounding Board on Risks of Nanotechnology. During the first meeting, the participating CSOs raised the question of whether or not they were still allowed, as a member of the Sounding Board, to distribute brochures or start campaigns. As a response, the Chair of the Sounding Board, Dick Jung, from the Ministry of Infrastructure and Environment, requested members to use the Sounding Board as a space to keep each other informed, to provide feedback and to reach common standpoints where possible. He emphasized that at the same time every member of the Sounding Board should continue with their own specific mandates and responsibilities in the wider world (public report of Sounding Board meetings between 2008 and 2010).

[49] In the words of a spokesperson for the Dutch Cosmetics Association: 'it is important that NGOs have a good understanding about why nanoparticles are used in products, not because we think it is fun, but because it serves a purpose (…) before NGOs express criticism of our products they should first come to us to inform themselves' (Interview, 2009, translation by the author). In a similar vein, a spokesperson for a Dutch chemical company argued: 'NGOs should not state beforehand what is good or not good. That is the sentiment that has arisen today. There are not many balanced stories in the world of NGOs' (translation by the author).

society organizations, including other non-governmental environmental organizations.[50] In response to the launch of the risk framework, an international coalition of more than twenty CSOs (e.g., Friends of the Earth, Greenpeace, ETC group and trade unions) developed a position paper (Civil society- Labor coalition, 2007) that was addressed to the 'international nanotechnology community at large'. In this position paper, the coalition condemned the partnership and the risk framework as 'fundamentally flawed'. They saw soft governance proposals as a tactic to delay or weaken rigorous regulation, adding that:

> *'We strongly object to any process in which public participation in government oversight of nanotechnology policy is usurped by industry and its allies (…) we do not engage in this process out of well-grounded concerns that our participation (…) would be used to legitimize the proposed framework as starting point or ending point for discussing nanotechnology policy. What is needed is a meaningful and open discussion on societal impacts, and urgent worldwide oversight priorities for nanotechnology.'*

This reflects a long-standing tension about participation as leading to being co-opted by the other side (the "other side" is for example management of firms). Instead of participation, CSOs address governments.[51]

What we see is that industry as well as the international coalition of CSOs have an interest in settling uncertainty and ignorance with regard to health and environmental safety issues of engineered nanoscale materials, but differ with regard to how to move forward to settle these issues. The implication is that symmetrical deliberation between a technology developer and a CSO in a dedicated, protected space for interaction may not be enough to achieve a settlement of the issue.

Section 3.4 In conclusion

What can be learned from this bottom-up experiment and the responses at the collective level? How did the space for interaction look like, and have public- sphere type interactions been realized between DuPont and EDF? What were enabling and constraining conditions?

[50] Thus, further positioning as a 'bad' NGO occurred, now from the other side: EDF was considered to have transgressed the rules governing how an NGO should behave.

[51] See for example a recent letter (April 2012) to the EU Commissioner of Environment, signed by 12 non-governmental environmental groups, in which they urge the EU Commission to pay more attention to toxicity issues of nanoscale materials and develop regulations.

Characteristics of the space for interaction

In view of the current division of labour in upstream engagement activities, the protected space that DuPont and EDF established and their subsequent productive interaction is quite unusual. What were contributing factors? One of the factors was that DuPont and EDF shared the concern about whether and how engineered nanoscale materials could pose health and environmental problems to society at large. Also important was the fact that the business model of each of the actors was sympathetic to these types of interactions in relation to risk assessment and risk management. Chemical company DuPont is known for being at the forefront of developing new risk management procedures; creating an interaction process with a new dialogue partner during the early stages of nanotechnology and providing access to actual production processes accords with this particular position. EDF is an atypical non-governmental environmental organization: whereas for most environmental groups, direct action via protest or media performances and lobbying government agencies is the common mode of operation, EDF has a long tradition of corporate partnerships. This is linked to their strong belief in the power of the marketplace. What also contributed to the realization of this particular partnership was the societal learning process that had occurred in Western societies in recent years with regard to managing newly emerging science and technology: DuPont as well as EDF had drawn on lessons learned from handling earlier emerging technologies such as GM and DDT. In a joint article for the *Wall Street Journal* they argued that in the field of nanotechnology 'an early and open examination of the potential risks of a new product or a technology' is needed, as well as more and better communication between different stakeholders (Krupp & Holliday, 2005).

DuPont and EDF created a protected space for deliberation. Thus, the interaction processes were not public; however, the outcome, the risk framework did become public, with a special website developed to this end (www.nanoriskframework.com). Furthermore, today the risk framework (and the partnership) has become a cultural resource that other actors in different contexts can refer to, up to taking specific elements into account. For example, the International Organization for Standardization (ISO) has built on the risk framework to develop their own guidelines (ISO/TR 31321) for nanotechnology-nanomaterials risk evaluation (www.iso.org/iso/catalogue_detail.htm?csnumber=52976).

The space which DuPont and EDF assembled was shaped by the requirements of the partners and by the aim to create a product that was robust, that is, one that could function in the wider world. The nature of the product was clear and agreed almost from the beginning. If this had not been the case, the co-construction process would have included discussion (negotiation) about the product and shifts in the definition of what the product should be. These considerations highlight

that the DuPont/EDF case may be an exceptional space for assembly. One cannot assume that there is always an agreement beforehand on the product to be realized in the space, and if there is not agreement, deliberation includes negotiation about what the eventual final product should be. In other words, this case does not allow immediate conclusions about designing a good space. It may well be that in general the complexities of the indeterminate situation cannot simply be reduced productively, so that there are no simple guidelines to design a space for assembly. However, at present there are attempts to do so, indicating that there may be learning how to do so.

Public-sphere type interactions

DuPont and EDF, as well as actors in the wider world, saw the partnership as dealing with a matter of public concern, namely an indeterminate situation regarding the health and environmental problems posed to society at large by engineered nanoscale materials. Thus, their interactions can be evaluated as public -sphere type interactions, even if they occurred in a protected space.

The Table below lists all of the possible public-sphere type interactions (cf. Chapter 2) and indicates which actually occurred in the case studied.[52] They will be discussed further below.

[52] Some items, such as probing and interactive rehearsal, can only be monitored through observation and/or transcripts of interactions, which I did not have.

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.	
	Public-sphere type interactions	**Co-construction project DuPont and EDF**
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.	+
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.	++ No data ++
Articulation	Articulation of emerging common, (public) issues	+
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks	No data
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)	++
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation	No data
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes	++

The involvement of EDF in the co-construction project was not based on their representing issues and concerns of civil society, but on their content and issue-specific contribution. Nevertheless, this contribution could confer legitimacy to the outcome because EDF is a CSO. Both DuPont and EDF had a stake, albeit in different ways, in addressing issues of health and environmental safety raised by nanoscale materials. For DuPont, as a manufacturer, this stake was the continuation of production of nanoscale materials. EDF wanted to realize particular environmental endpoints – such as cleaner energy production – with the help of nanotechnology, but before they could support the development of nanotechnology, potential risks had to be addressed. Thus, ways to frame inquiry into and assessment of health and safety issues of nanoscale materials was a common concern for DuPont and EDF.

In traditional public sphere theory it is assumed that a situation in which all actors can share their perspectives and stakes, and in which there is interactivity, will lead to a better understanding of the nature of the indeterminate situation, and articulation of societal issues that need to be addressed. In this case, both the issue and what needed to be done were already determined: a framework addressing the possible health and environmental risks of engineered nanoscale materials was required. This question was already on the agenda at DuPont and EDF, through discussions by DuPont with stakeholders, for example through participation in ICON; and through EDF's exploration of nano issues. During the project, the emphasis was on the further articulation and negotiation of what should be included in the risk framework.

At the start, EDF was not positioned as a knowledgeable actor by the DuPont staff, with the latter's project members insisting that an understanding of the science involved and an understanding of the balance that a company seeks to find between technological innovation and stewardship was a prerequisite to a productive collaboration. They doubted whether an NGO could have such knowledge. However, interactivity and mutual learning was stimulated in the pre-project phase and in the small project groups (which were specific orchestrations to structure their collaboration), which contributed to the DuPont staff changing their views about EDF as a knowledgeable actor. Consequently, there was symmetrical interaction, with DuPont and EDF using the opportunity to share their stakes, values and issues.

Moreover, there was recognition by both partners that other societal issues existed and should be addressed. So there was articulation of issues, but DuPont and EDF chose not to take these broader societal issues into account. Other actors should do that.

Occasion to extend the public sphere?

Was this partnership between a firm and an environmental organization a one-off affair or does it herald gradual changes in the traditional division of moral labour and the forms of interaction between industry and civil society actors? The case itself was a one-off, with DuPont and EDF going their own ways. However, their project was visible and continues to be referred to by various actors. Thus, it was an opening in the traditional division of moral labour between industry and civil society actors such as NGOs. As the case shows, there is a challenge involved. A somewhat protected space may be necessary to conduct joint inquiry. However, protected spaces imply exclusion of other actors and other aspects. While this allows the interactions to be productive on their own terms, it may limit their uptake and impact at the collective level. Thus, there is another element to be taken into account: the wider world and its force fields. We can conclude that the creation of such spaces for co-construction is not a matter of course in the wider world. Chemical companies may be open to involvement with CSOs but reluctant to give them access to sensitive information. CSOs are reluctant to participate for fear of being co-opted, or being seen to have been co-opted. The Dupont/EDF project challenged these accepted positions and led to articulation processes on the side of industry and of CSOs concerning the appropriate roles and responsibilities with regard to the development and governance of NEST. The outcome might be a re-affirmation of traditional roles (at least for the time being), or some opening up. In the latter case, there will be some extension of the public sphere. It is also clear that co-construction projects will require protected spaces. Thus, through this route an extension of the public sphere to include NEST would be like a patchwork of partially interconnecting protected spaces.

Chapter 4 Spaces for capacity building for civil society organizations

Introduction

Policymakers (particularly at the European level) expect civil society organizations (CSOs) to participate as new and knowledgeable dialogue partners in the development and anticipatory governance of newly emerging science and technology (Commission of the European Communities, 2001, p. 14). Recognizing that CSOs first have to build capacities to be able to do so, the European Commission started to provide resources for capacity-building programmes to allow CSOs to gain awareness of research activities (including nanotechnology) and build competences. Some of these programmes worked by creating spaces for assembly and deliberation between CSOs and technology developers, which make them interesting with respect to the research questions of this thesis. In this chapter, I study the formation and interaction processes in one such capacity-building project for CSOs called NanoCap,[53] which was funded through the Science and Society Programme in FP6, the EC's 6th Framework Programme for Research (www.nanocap.eu). NanoCap is the abbreviation for 'Nanotechnology Capacity Building NGOs'. One main aim of the NanoCap project was to develop capacities of environmental organizations and trade unions to enable them to participate in debates on nanotechnology at the national and European levels. This included the development of position statements by the participating CSOs on environmental and occupation health issues concerning nanotechnology, supported by scientific input and embedded within a broader policy context (www.nanocap.eu). In terms of my research questions, it is interesting that the formation of the local space to deliberate about nanotechnology was not initiated by the CSOs themselves. For most of the CSOs that participated in NanoCap, nanotechnology was not yet a matter of concern when they were invited to participate.

The European Commission's diagnosis that CSOs first have to build capacities to participate as new, knowledgeable dialogue partners, was taken up by the initiator (and later coordinator) of the NanoCap project as the starting point of the project. I will first indicate how current capacity-building programmes for CSOs are part of an overall move by the European Commission towards inclusive participatory governance. After specifying the research question and methodology, I will analyse the

[53] NanoCap: 'Nanotechnology Capacity Building NGOs' http://cordis.europa.eu/projects/rcn/81267_en.html, last visited on 9 August 2012.

NanoCap project and end with conclusions and reflections about what can be learned from the NanoCap project about good spaces that allow for public-sphere type interactions.

Inclusive, deliberative governance for newly emerging nanotechnology

The European Commission's positioning of civil society organizations as new dialogue partners in research and technology development is recent. Problems of legitimacy and a lack of interest, even distrust, of citizens in EU policymaking processes led the EC to publish a White Paper on governance in 2001 (Commission of the European Communities, 2001, p. 3), in which goals and requirements to broaden and reshape European democracy were formulated. Compared with the earlier idea of parliamentarization and 'permissive consensus', considered 'as the most obvious path to enhance legitimacy of the EU' (Finke, 2007, p. 4), the White Paper on governance saw greater and better involvement of citizens and civil society organizations as the appropriate response to deal with the problems (cf. Finke, 2007; Kohler-Koch & Finke, 2007), arguing that citizens and civil society organizations should participate as actors in European political processes (Commission of the European Communities, 2001, p. 5). European citizenship should, as the EC puts it, not only be a legal reality but also a political reality (ibid., p. 7), stimulating and reinforcing a culture of information, consultation, dialogue and the formation of European public opinion on transnational matters of concern (ibid., p. 12).

The EC affords everyone a role and responsibility in the new governance culture, and expects institutions to become more open, transparent and responsive towards the needs and demands of civil society (Commission of the European Communities, 2001, p. 16). Citizens are expected to engage more actively with political decision-making, and civil society organizations are considered to play an important role in giving voice to the concerns of citizens and delivering services that meet people's needs (Ibid., p. 14).

It is within this policy context that the European Commission formulated its Science and Society Action Plan in 2002, in which the requirements to reshape the relationship between science, technology and society, including the involvement of citizens and civil society organizations in the creation of a strong, competitive, knowledge-based European economy, one that is 'responsive to societal needs and concerns', were outlined. Consequently, it is important for civil society to be aware of developments in science and technology, so public opinion can be formed. One route is to provide 'more education [and] more media attention to the dissemination of scientific information' (EC, 2002, p. 7-9). The Action Plan stipulates that merely providing more information is 'not sufficient

for civil society organizations to become partners in the debate on science, technology and innovation and on the creation of the European Research Area in particular' (EC, 2002, p. 14). Civil society organizations must be 'given the opportunity to express their views in the appropriate bodies' (EC, 2002, p. 17).

Four years later, the Science and Society Programme articulated the roles and responsibilities of civil society and civil society organizations further in terms of creating an 'inclusive participatory governance' that helps to better take into account the relationship between technological innovation and aspirations and concerns of civil society' (EU Science and Society Work Programme, 2005). Not only are CSOs given new roles, but researchers are also asked to 'communicate more' and 'to be responsive to society's needs'. In the words of the policy officer of EC DG Research, Von Schomberg: 'good governance will have to go beyond policy making focused on legislative action (…) the ideal is a situation in which all the actors involved communicate and collaborate (…) the framing of public policy will be dependent on the ways that public interests and scientific insights are articulated' (Von Schomberg & Davies, 2010, p. 8, 12).

For CSOs to become new dialogue partners, the EC argued, capacity-building will be required, and the FP6 Science and Society Programme thus funded several capacity-building projects such as CAPOIRA, a capacity-building project encouraging patient organizations to participate in research,[54] and STACS, a project designed to give an overview of mechanisms that might assist the inclusion of CSOs in the research process.[55] The CIPAST project focused more on citizens in general, organizing training sessions on how to include citizens in the research process.[56] A call for Science Shop projects was also launched, in which research was funded for the benefit of CSOs[57] and, through the TRAMS project,[58] capacity was to be built to start more Science Shops as brokers between the research domain and CSOs. Eventually this led to the financial programme 'Research for the Benefit of Specific

[54] CAPOIRA: Capacity-building for patient organizations to participate in Research Activities http://cordis.europa.eu/projects/rcn/84160_en.html. last visited 9 August 2012.

[55] STACS: Science, technology and civil society - Civil society organizations, actors in the European system of research and innovation http://cordis.europa.eu/projects/rcn/84153_en.html, last visited 9 August 2012.

[56] CIPAST: Citizen Participation in Science and Technology http://cordis.europa.eu/projects/rcn/74467_en.html, last visited 9 August 2012.

[57] http://cordis.europa.eu/fp6/dc/index.cfm?fuseaction=UserSite.FP6DetailsCallPage&call_id=263, last visited on 9 August 2012.

[58] TRAMS: Training and mentoring of science shops http://cordis.europa.eu/projects/index.cfm?fuseaction=app.details&TXT=trams&FRM=1&STP=10&SIC=&PGA=&CCY=&PCY=&SRC=&LNG=en&REF=74472, last visited on 9 August 2012.

Groups – Civil Society Organisations' in FP7 (personal communication, Mulder, 2012). [59] In FP7, the Science in Society Programme, as it was renamed, funded a capacity-building project for CSOs in sustainable agricultural research, CRÊPE.[60]

In the domain of newly emerging nanotechnology, the EC's policy of stimulating 'good governance' and the articulation of public interests is visible in how resources are allocated to early public engagement, and also in the development of a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research (Commission of the European Communities, 2008) as part of the broader move towards Responsible Research and Innovation. The Code of Conduct is a much broader and more proactive venture than writing Calls for Proposals for projects. Member States are asked to consider the Code of Conduct and implement it. The guiding principles of the Code of Conduct call for a reordering of positions and responsibilities of institutions involved in the innovation process. The Code of Conduct demands other ways of defining research agendas and accountability than normally is the case in universities or industry. With regard to inclusiveness, the Code stipulates that 'nano-research activities should be guided by the principles of openness to all stakeholders, and should allow the participation in decision-making processes of all stakeholders involved in or concerned by nano-research activities' (Commission of the European Communities, 2008, p. 6). With regard to accountability, it states that 'researchers and research organizations should remain accountable for the social, environmental and human health impacts that their nano-science and nanotechnology research may impose on present and future generations' (ibid., p. 7). One implication for CSOs is that they are called on to take a position in the innovation process, and not just as a watchdog outside the innovation chain (Von Schomberg, 2012). As EU policy officer Von Schomberg explains: 'the most crucial advancement of RRI will be dependent on the willingness of stakeholders to work together toward socially desirable products (…) the advantage is that actors cannot exclusively focus on particular aspects (for instance, civil society organizations addressing only the risk aspects) but have to take a position on all aspects of the innovation process as such' (Von Schomberg, 2013).

This is a new situation for CSOs, who would traditionally respond after the introduction of new technologies or products, remaining outside the innovation chain, as well as a new situation for government, industry and science, because traditionally only the latter three groups of actors had responsibilities to develop and embed newly emerging science and technology. Scientists working on

[59] http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1298, last visited on 9 August 2012.

[60] CRÊPE: Co-Operative Research on Environmental Problems in Europe http://crepeweb.net/, last visited on 9 August 2012; and http://cordis.europa.eu/projects/index.cfm?fuseaction=app.details&TXT=crepe&FRM=1&STP=10&SIC=&PGA=&CCY=&PCY=&SRC=&LNG=en&REF=89671,last visited on 9 August 2012.

new science and technology develop and define their own research agendas (within the constraints of their organization's policies and funding priorities) and are allowed to do so because of their purported responsibility to work towards progress through knowledge production (cf. Shelley-Egan, 2011). The request from the EU to allow 'participation of all stakeholders' in decision-making processes is thus a new and challenging situation for nanoscientists.

However, there are also challenges for CSOs, such as the environmental organizations and trade unions that were to take part in the NanoCap project. To be involved as a dialogue partner in decision-making processes during the early stages of a newly emerging technology development is not part of the usual mode of operation of trade unions and environmental organizations. Normally they lobby governments and/or take direct action to warn and inform the general public about possible risks and hazards. It is also a matter of scarce resources, as Hanssen et al. (2008) observed: CSOs have to make choices and nanotechnology may not be high on their agenda.[61] Nevertheless, some were willing to participate in the NanoCap project.

Structure of the chapter

This chapter will analyse how the CSOs that participated in NanoCap positioned themselves, and also reflect on to what extent the interaction processes that occurred can be seen as public-sphere type interactions. I will discuss three questions: 1) What were the characteristics of the space for assembly? 2) Were public-sphere type interactions realized in this space, and if so, in what way? That is, how were these interactions conditioned by the nature of the space? and 3) What does the case study imply for the possible extension of the public sphere with regard to emerging sciences and technologies?

Nanotechnology was new to most of the CSOs involved. As part of the NanoCap project, they had to develop positions; moreover, these positions had to be 'within the actual policy context and supported by scientific input' (www.nanocap.eu). This goal implied that the CSOs had to become aware of a research area new to them. They were expected to gather knowledge (thus inquiry) and link this to wishes, demands and possibilities in their organization (thus further inquiry and articulation) in order to arrive at position statements and, eventually, ways to inform their members.

[61] In a recent study of the positions of labour unions on the implications of newly emerging nanotechnology for workers, Invernizzi (2012) concluded that nanotechnology has received limited attention within labour unions thus far because it is not perceived as important (in Australia and the United States), and/or because unions are overwhelmed with existing problems and nanotechnology is only a long-term concern (in Latin America).

Data collection

As an observer at NanoCap meetings, I read internal as well as publicly available documents provided by NanoCap (available at www.nanocap.eu). After an interview with the project coordinator, Pieter van Broekhuizen, on the realization of the project, its objectives and the interaction processes that took place, Van Broekhuizen invited me to join some of the NanoCap activities. One such activity was the meeting between some CSOs participating in NanoCap and a German-based international chemical company. The main aim of this meeting was to exchange viewpoints between the CSOs and the chemical company on what constituted a good risk management approach. I also attended a working conference on the ethical and societal challenges of nanotechnology organized by NanoCap's partner Darmstadt Technical University. During this working conference, CSOs were invited to inquire into this topic of ethical and societal challenges. In addition they were invited to anticipate the best ways to incorporate the new roles and responsibilities envisaged for them by the EC. In my observations I focused on whether and how CSOs inquired into newly emerging nanotechnology and its indeterminacies, which issues were articulated and how they arrived at an aggregation of discussions in position papers. I paid specific attention to how CSOs articulated their own roles and responsibilities, as well as those of other stakeholders.

I attended the closing event organized by NanoCap in 2009. During this event, the environmental organizations and trade unions presented their position papers, and dedicated panel discussions were organized about issues of concern raised by the CSOs in these papers. I have also looked at further steps taken by the European Commission, from 2009 onwards, with regard to capacity-building for the creation of inclusive participatory governance in science and technology. These steps of the European Commission can be seen as an attempt to extend the public sphere to include deliberation on newly emerging science and technology.

All of the interviewees consented to the use of quotes from the interviews (though the interpretation is of course mine). At the meetings I took notes, which included my reflections on what was happening. When I quote individual participants based on my notes they are anonymized. All references to internal project documents have been authorized by NanoCap's project leader.

Section 4.1 The NanoCap project

The proposal for the NanoCap project was developed by Pieter van Broekhuizen.[62] One of his tasks as a consultant with IVAM (www.ivam.nl) was to advise the Dutch trade union FNV on worker safety and the risks of chemicals, and this led him to consider engineered nanoparticles and their potential to create novel hazards for humans and the environment. He was alerted by the fact that in spite of the many uncertainties and unknowns with regard to the environmental and occupational health risks of engineered nanoparticles, production processes involving engineered nanoparticles was occurring. Consequently, when the FP6-Science and Society Call appeared, he saw this as an opportunity to modify and improve this situation.

Following the specifications in the Call, the aim of the NanoCap project was formulated as enabling environmental NGOs and trade unions to deepen their understanding of 'environmental and occupational health and safety risks, and ethical aspects of nanotechnology', by providing scientific input and organizing meetings with industry (www.nanocap.eu). 'Structured discussions' (e.g. working conferences) were to be organized between environmental CSOs, trade unions, academic researchers and companies. The ethical dimension of science and new technologies, one of the items in the Call for the Science and Society Programme (European Commission Directorate-General for Research, 2005), was taken up in the NanoCap proposal for opportunistic reasons – to increase the chance of being awarded funding, Van Broekhuizen explained (interview 02-2008) – but the inclusion of ethics also had more fundamental grounds:

> *'Risk assessment takes place within a normative framework, where, especially if you want to operationalize the Precautionary Principle, quite a number of agreements need to be made that are not contained in rules. In this respect, ethics plays an essential role. Transparency on this point in the interaction process with the NGOs can stimulate thinking about this. Thus, ethics was not just included because it is a hot topic, but because it was also a condition for a well-shaped process.'* (translation by author)

While one aim of the NanoCap project was to raise awareness within environmental organizations and trade unions, they were also asked to develop position statements on the issues and to formulate recommendations for public authorities and industry on how they might deal with

[62] Van Broekhuizen has a background in chemistry, was director of the Chemistry Science Shop of the University of Amsterdam and when this Science Shop became part of IVAM UVA Ltd in 2003 (IVAM is a Dutch research and consultancy group dealing with occupational, and environmental chemical risks, www.ivam.nl) he became member of IVAM.

emerging societal issues. Five universities participated in the NanoCap project and they were assigned the responsibility of providing scientific input. As Van Broekhuizen put it:

> *'Government and industry, after experiencing the contestation of genetically modified food, believed that unions and NGOs held unfounded opinions. NanoCap's objective is not that NGOs should either stimulate or discourage nanotechnology. Rather, if you are going to talk about it, it should be done in a knowledgeable way.'* (translation by author)

The mission of the NanoCap project was to build capacities for CSOs so that they could 'inform their members and the general public'. This implies a particular division of labour, which returns in the idea that the participating CSOs should develop recommendations for public authorities and industry so as to enable them to facilitate the safe and responsible development of nanotechnology. In other words, the actual realization of safe and responsible development lies with public authorities and industry.

To solicit partners for NanoCap, Van Broekhuizen approached actors in his networks. Many environmental groups and trade unions responded negatively, stating that it was not on their agenda. The umbrella organization of Mediterranean environmental organizations (MIO-ESCDE) expressed interest in participating, but was concerned that only a very small number of the members they represented would be interested in the topic because there was as yet no nano-discussion in Mediterranean countries. Nevertheless, MIO-ESCDE finally decided it would participate and over time its members welcomed the NanoCap project (email conversation 05-09-2012). Potential partners from England, on the other hand, saw no need to join the NanoCap project because they already had a national nano-policy. Ultimately, environmental groups from the Netherlands, Italy and Lithuania participated, in addition to MIO-ESCDE and a European umbrella organization for environmental NGOs. Trade unions from Ireland, Germany, Austria and the Netherlands, as well as a European umbrella organization of trade unions also became partners. The participating universities were from England, Denmark, Belgium, Germany and the Netherlands.

Section 4.2 Interaction processes in the NanoCap project

The actual interactions that occurred during the NanoCap project in meetings and in events can be analysed against the criteria for public-sphere type interactions (see Chapter 2). I will discuss the articulation of issues and aggregation separately, because these occurred in different activities.

Inquiry and articulation of issues

Within the NanoCap project, five working conferences were organized by the different universities in order to enable CSOs to gain a better understanding of nanotechnology's ethical aspects and environmental and occupational health and safety risks. The programmes for these working conferences were largely determined by preceding deliberations in the project team (Van Broekhuizen & Reijnders, 2011, p. 4). The first working conference covered a broad range of topics, ranging from nanoethics to EU policy on REACH, the Polluter Pays Principle and the precautionary approach.[63]

Issues of concern were further elaborated and the topics of focus for the other working conferences were decided upon.[64] As a NanoCap progress report phrased it, the key question for NanoCap was 'how to deal with uncertainty and ambiguity in managing risks stemming from the use of nanomaterials in workplaces and from the release of nanoparticles in the environment' (Van Broekhuizen & Schwarz, 2010, p. 90). Accordingly, 'more specific topics, not directly related to workers' exposure risks or environmental threats (such as medical nanotechnological applications, nano-electronic applications and military nanotechnology), were largely left outside the scope of the formal discussions' (ibid., p. 82).

The project team's midterm review indicated that not every partner in NanoCap agreed with this focus on risks of engineered nanoparticles. In particular, one of the university partners raised the question of whether this focus was too narrow. In the responses, one can see how CSOs perceived

[63] REACH is the European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with Registration, Evaluation, Authorization and Restriction of Chemical substances. The Polluter Pays Principle states that 'whoever is responsible for damage to the environment should bear the costs associated with it' <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004L0035:EN:NOT>. The precautionary principle allows for action, e.g. by regulators, even if evidence is not complete or conclusive, provided the risks of non-action are proportionally greater (Commission of the European Communities, 2000) (see also Rip, 2006).

[64] The first working conference was centred on several themes: What is or is not known about the risks of nanoparticles during their life cycle; nanoethics past and present – new materials, miniaturization and recurrent promises of the technological fix; the precautionary principle and nanotechnologies; REACH, liability and the polluter pays principle. The second working conference was centred around engineered nanoparticles (e.g. nanoparticle catalysts, nanoparticle carriers of small interfering RNA, titanium oxide nanoparticles). The third workshop assessed environmental and occupational health issues, while the fourth workshop addressed the ethical and societal challenges of nanotechnology. The last workshop examined the benefits, economic and otherwise, of nanosciences and technologies (for more details, see www.nanocap.eu).

their roles and responsibilities in relation to the question of how to deal with uncertainties and ambiguities concerning engineered nanoparticles. As one participant stated:

> *'Trade unions and NGOs are defensive organizations. Therefore it is logic [sic] that we follow/focus on a risk-approach.'*

Another participant added:

> *'It is not the task of trade unions and NGOs to solve the problem of nano-risks. However, it is their task to scream about their risk-potential.'*

Clearly, these responses of NanoCap participants reflect an outsider's position, to voice concerns and perhaps 'scream' about the issues.

What NanoCap members did engage in was inquiry, investigating the central focus of the project. Prior to the working conferences, the university members offered the relevant literature. During the working conferences there was time scheduled for discussion, both for the CSOs among themselves as well as with the universities involved.

In addition, a number of NanoCap members visited industrial firms, approaching these companies themselves. Van Broekhuizen indicated that not all companies responded enthusiastically, and he had to make many follow-up calls and send many emails. In the end, meetings occurred with BASF, Evonik Degussa, Bayer and IMEC.[65] These visits were thoroughly prepared and evaluated afterwards by the NanoCap partners. For the preparation, they sent each other lists with possible questions, and an agenda was drawn up. After the visits, the NanoCap partners contacted the company if further clarification was required concerning topics that had received too little attention during the visit.

I was present as a participatory observer during one of the company visits. For the company, this was an unusual meeting compared to their regular Open House events dedicated to providing information to visitors. The stated aim of the meeting between the company and the CSOs participating in NanoCap was to exchange viewpoints on how to assess and deal with health, environment and safety issues related to engineered nanoparticles. While such an aim could lead to public-sphere type interactions, what happened was that a few days before the meeting the company came up with a final agenda that reserved four out of five hours for transmitting

[65] IMEC is not a firm but a large research institute in Flanders (Belgium) with many connections with industry.

information on nanotechnology and the company's Responsible Care Programme. Items brought up by the CSOs prior to the meeting, such as stakeholder dialogues, were scheduled for the end of the meeting and allocated thirty minutes jointly with an item called 'Discussion and summary'. During the meeting, the Chair (a senior staff member of the company) decided to skip the issue of stakeholder interaction entirely, because time had run out (due in fact to the long monologues by company staff). This was an extreme case, but the emphasis on communication as transmission rather than as transaction was a feature of all company visits: an approach which companies fall back on in such a novel situation.

Section 4.3 Aggregation of discussions in developing position papers

The knowledge, impressions, opinions and perspectives that each of the CSOs had been exposed to over the three years of NanoCap had to be aggregated into a position paper at the end of the process. Each CSO developed a position paper and discussed draft versions of their position papers with their constituency (Van Broekhuizen & Schwarz, p. 92). The five trade unions and five environmental organizations decided that it was important to formulate position papers connected to the current nano-dialogues in their respective countries. However, to be more effective at the European level, the trade unions and the environmental CSOs decided to also develop joint positions. The impressions and experiences of the CSOs were formulated as demands. One such demand, from trade unions as well as environmental organizations, was for openness and transparency in the industry with regard to the safety of production processes, and the need for the EU to set rules to ensure this.

In their position papers, trade unions and environmental organizations pointed out ways of dealing with uncertainty and ambiguity in managing risks of engineered nanoparticles. The trade unions took the precautionary approach as the starting point of their position papers and proposed concrete measures to realize 'transparent risk information for the workplace' and 'openness on nanoproduct composition' (Van Broekhuizen & Schwarz, p. 92). For the environmental organizations, precaution, openness and transparency were also key items. They considered it essential that 'safe and responsible' nanotechnology required the modification of the existing regulatory framework to encompass materials on the nanoscale (ibid., p. 98). However, they were not optimistic, at least, in the midterm review it was noted that the CSOs did not expect the EU to develop appropriate legislation.

It is striking that in almost all position papers, the CSOs position themselves as outside the innovation chain, only formulating requirements for others. Responsibilities are allocated to technology developers and governments, but not, at least not explicitly, to themselves. An example is how the Italian environmental organization Legambiente addressed manufacturers, EU policymakers, researchers and industry. Policymakers, they stated, must 'urgently' regulate the development of nanotechnologies:

> *'Researchers and industries must apply a risk assessment with standard criteria for every single application of nanotechnologies/materials and compare these results with the benefits these technologies could offer. Manufacturers must provide all data about nanomaterials contained in their products through a labelling system'.*[66]

The coalition of Lithuanian non-governmental environmental organizations urged the European Commission and Member State governments to establish a legally binding framework for safety assessment during the whole life cycle of nanomaterials. In addition, the coalition also called for the development of material safety data sheets for engineered nanoscale materials, with the aim of informing downstream users about the health and safety risks throughout the whole life cycle of nanomaterials. The coalition did not specify who should take responsibility for developing these material safety data sheets.

The Dutch organization Natuur en Milieu (SNM) and the umbrella organization of Mediterranean environmental organizations (MIO-ESCDE) defined a role and responsibility for themselves: 'to play a leading role in the societal dialogue on environment and health aspects' (SNM) and to provide an 'objective and representative view and perspective of Mediterranean civil society on emerging nanotechnology issues in relevant European and international fora' (see for more details www.nanocap.eu/publications).

The nature of the claims of the trade unions and environmental groups reflect a certain traditional division of roles and responsibilities in which there is little else at stake for CSOs during an innovation trajectory than expressing concern about things that might go wrong. This impression is reinforced when one considers the responses of the participants to an assignment during the working conference on the ethical and societal challenges of nanotechnologies. The CSOs were asked to study the proposed EU Code of Conduct (2008) and, in four small sub-groups, to anticipate the potential implications of this EU Code of Conduct, such as the proposal of the EU that CSOs

[66] See www.nanocap.eu/Flex/Site/Download4648.pdf?ID=4214.

participate as stakeholders in the innovation chain. There was some reluctance to complete this assignment, to the point of refusal. As a trade union participant said:

'It is my task to check whether companies operate safely. What else do you want me to think about?'

The same attitude was visible in the remarks of some trade unions concerning ethics: they were aware of the discourse on ethics and understood its importance for philosophers and policymakers, but did not relate it to their own world:

'Our priorities are with workers' safety, knowing whether it is safe or not on the work floor.'

This was not seen as an ethical issue by the participating environmental groups and trade unions.

In the midterm review, all of the participating universities, trade unions and environmental groups indicated what they had learned thus far, and which topics they would like to be addressed during the second half of the project. All the NanoCap partners expressed appreciation for NanoCap, with its many formal and informal contacts within the project team and with other stakeholders. They considered that their knowledge of nanotechnology had increased, and some CSOs stated that they could now participate in discussions with industry and would be able to share their knowledge with members of their organizations and possibly with wider society. They also realized that there were still many unknowns and uncertainties concerning risks, and had become aware of the complexity and indeterminacy associated with the development and governance of nanoscience and technology: 'I learned that nobody knows', 'knowledge is not enough', there is a 'complexity of risk issues', were some of the comments in this respect. Participating CSOs also concluded that the benefits of nanotechnology were still unclear and that this required attention. This broadened their agenda for discussion, from a 'risk' discourse towards a 'risk-benefit' one. This was taken up in the topic of the fifth working conference on the economic benefits of nanotechnology.

Section 4.4 The closing event: a confrontation with the wider world

Whereas the NanoCap project functioned as a protected space for interaction among the participants, towards the end of the project in 2009 there was a dedicated attempt to open the project to the wider world. To this end, NanoCap partners organized a closing event at the European Parliament in Brussels, in which the position papers were presented to nanotechnology developers

and policymakers in order to stimulate discussion, in particular with regard to the issues of workplace safety and implementing the precautionary approach (see www.nanocap.eu for more details). Representatives from industry, science, employers' organizations and policy were present. As it turned out, there was little interactivity between CSOs and nanotechnology developers on the issues that were addressed by CSOs in their position papers. This may have been due to the format of the meeting, where CSOs were in a sense invited to use a transmission mode of communication in presenting their position papers. On the side of nanotechnology developers, there was little response to the issues as presented by the CSOs, and no further articulation of their visions, the challenges or struggles ahead.

During a panel discussion moderated by the EC policy officer Von Schomberg, in which NanoCap members and representatives from industry participated, items from the position papers were only taken up as matters of common concern for all participants when the moderator identified them as such. For example, he mentioned indeterminacy with regard to assessing the risks of nanoparticles: 'What does it mean for legislation in Europe that there are no risk assessment methods for nanoparticles?', and 'Once we have assessed the risks, how do we decide whether these risks are acceptable or not?' These questions could be considered a matter of concern for CSOs and nanotechnology developers; for CSOs because they addressed these items in their position papers, and for industrialists because legislation and risk assessment are an integral part of the context within which they work. When asked by the moderator, participants in the panel discussion did articulate some dilemmas, positions and expectations. For example, in response to the question about how to decide whether risks are acceptable or not, the spokesperson from the European Environmental Bureau (EEB, an umbrella organization for environmental groups) said:

> '*We should apply the precautionary principle when data are insufficient. This comes before a discussion on which risks are acceptable. Acceptability should be decided by public debate (…) and consequently: no data, no market*.'[67]

During the panel discussion, the participants rarely responded to each other's visions and positions and did not question each other.

One could say that the limited interactivity between NanoCap partners and nanotechnology developers does not speak favourably to the challenge of achieving the European Commission's goal of the creation of inclusive, participatory governance for new technologies such as nanotechnology.

[67] www.nanocap.eu/Flex/Site/Downloadaa1d.pdf?ID=4664

On the part of the CSOs, there was not much interest in having an active role as knowledgeable dialogue partners, and in the discussion at the closing event, an EC policy officer and a member of the European Parliament offered similar views when they linked the participation of civil society in science and technology to 'monitoring' and 'vigilance':

> *'Public dialogues are instruments for vigilance and to monitor ongoing developments.'*

Their argument for capacity-building for CSOs was thus not for the sake of inclusive governance but to identify barriers to further development and fostering acceptance:

> *'Public dialogue on nanotechnology is necessary to identify barriers and boost the EU economy.'*

Thus, even though stakes had been articulated by the NanoCap members, during the closing event these were not taken up by other stakeholders for further exploration and negotiation. In this respect, one could say that the wider world was not waiting for the capacities that the NanoCap project was supposed to develop.

Section 4.5 In conclusion

In this final section I will discuss three questions. First, what were the characteristics of the space for assembly? Second, have public-sphere type interactions been realized in this space, and if so, in what way; in other words, how were these interactions conditioned by the nature of the space? And third, what does the case study imply for the possible extension of the public sphere with regard to emerging sciences and technologies?

Characteristics of the space for assembly

In NanoCap, the space for assembly resulted from the intersection of the European Commission's overall goal of inclusive governance requiring the capacity-building of CSOs and the proposal by Van Broekhuizen to create specific ways to build such capacity while inviting CSOs to participate. The interactions that resulted were shaped by the steps envisaged in the project. While modifications were possible, the project proceeded essentially as planned. The CSOs were invited to participate

and accepted, sometimes after hesitation. They were then offered the opportunity to formulate what they considered to be at stake for them. This could be input into interactions with nanotechnology developers, although this was not an explicit part of the project (except for the final event and excursions to companies). The assignment for the participating CSOs was to have their issues, stakes and concerns written up in publicly available position papers to be found on the website that was developed for the NanoCap project (www.nanocap.eu).

Through its focus on capacity-building, the overall aim of the European Commission was to create inclusive participatory governance for newly emerging nanotechnology, in which industry, science, policymakers and CSOs all play a role. However, in this focus there is an implicit argument to postpone actual deliberation and negotiation between civil society organizations and actors with institutionalized roles and mandates to develop and embed nanotechnology. Until the CSOs have the required competences they cannot fulfil their new role. Such a requirement is often articulated by companies, as we saw in Chapter 3. The EC is continuing its efforts in capacity-building, although there are also experiments in interaction and thus learning-by-doing, for the CSOs. Actually, learning-by-doing might be important for industry as well, as they may have knowledge about the technology but not about engaging in a dialogue with CSOs about new technology.

Public-sphere type interactions

Even if the set-up of the NanoCap project in which capacity-building for CSOs was stimulated may not have been very conducive to public-sphere type interactions, one can learn from what occurred. The Table below offers an overview, scoring the possible public-sphere type interactions as formulated in general terms in Chapter 2. Below I will offer some comments and make some differentiations based on the information presented in the Table.

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.	
	Public-sphere type interactions	**NanoCap project**
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.	-
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.	- - +
Articulation	Articulation of emerging common, (public) issues	+
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks	-
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)	+
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation	-
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes	+

Many of the negative scores are not indications of failure but merely reflect that the aim was to build capacity, with the consequent emphasis on teaching and learning by CSOs, rather than stimulating

public-sphere type interactions between CSOs and actors developing newly emerging nanotechnology. For example, the participating universities were allocated the task of providing CSOs with the necessary education materials and were not expected to share their own stakes, dilemmas and concerns during the interactions. The participating CSOs deliberated and negotiated among themselves and with their constituencies (about what should be included in the position papers), but not with other stakeholders such as industry and science, although there was an opportunity to do so. This is why the item on symmetrical interaction was given a negative score. As noted in Chapter 2, a matter of common concern (in this case indeterminacies with regard to the risks of engineered nanoscale particles which were recognized as important by all parties), need not automatically lead people to question each other to gain a better understanding and thereby attempt to settle problematic issues. Here this had to do with the fact that the setting emphasized capacity-building, but it was also apparent that participants fell back on existing roles. The CSOs were comfortable among themselves in their somewhat protected space, and otherwise relied on their standard positioning as being outside the innovation chain and act as critical commentators, or merely gathers of information about health and safety aspects of nanotechnology and push the EC to regulate. Thus, from the perspective of the participating CSOs it was already clear what their role and responsibility should be. Subsequently, an interactive rehearsal on how to address problematic issues did not seem necessary to them.

The feature of probing or questioning each other was also given a negative score because, as argued in Chapter 2, this feature relates to the phenomenon of different types of actors questioning or probing each other's worlds. This did not happen during the NanoCap activities. We did see, however, that the participating CSOs inquired into different activities conducted by nanotechnology developers via orchestrated working conferences and company visits. Based on their study of actual nanotechnology developments, the CSOs articulated new or adapted roles and responsibilities for nanotechnology developers with the aim of addressing indeterminacies concerning risks of engineered nanoscale particles more productively.

Occasion to extend the public sphere?

The NanoCap project may have broader impacts through follow-up activities by the participants and by being a model for further projects. I conclude this chapter with notes on these follow-up activities and how the EC is continuing along the road of capacity-building, as well as consider how these might be related to an extension of the public sphere.

Are the partners in NanoCap now applying the capacity that was built? As a direct result of his involvement, Van Broekhuizen is often asked to take part in stakeholder meetings on risk assessment and risk management, for example, in the Dutch Sounding Board on 'Risks of Nanotechnologies' and as a consultant to the Dutch trade union FNV during their meetings with the SER (the Dutch Socio-Economic Council) (Van Broekhuizen, 2012). The Irish trade union now takes part in European consultations, as does the European Trade Union Institute's Health and Safety Department. The umbrella organization for Mediterranean CSOs has launched a website based on the knowledge they gained in the NanoCap project, and updates this website with information on recent nanotechnology developments.[68] The environmental organization Legambiente is still conducting activities in the field of nanotechnology, in particular with regard to the risks and benefits of nanotechnology for health (email correspondence 16-08-2012). The Dutch environmental organization Natuur and Milieu participated in the Dutch Societal Dialogue on Nanotechnology (2009-2011) through a project designed to inform Dutch citizens about the possible health and safety issues related to nano-cosmetics (www.nanocontrole.nl) (see also Chapter 5). BEF Lithuania returned to business as usual because they lacked further resources (email correspondence 17-08-2012).

As for the EC, support for the early involvement and capacity-building of CSOs continued in its Science and Society Programme, now called Science in Society (SiS), with a budget increase from EUR 80 million in FP6 (0.42%) to EUR 330 million in FP7 (0.62%) for the whole programme. CSOs are increasingly seen as research partners, for example in the SiS work plan for 2009, where a call for proposals was launched to 'foster a deeper and more systematic engagement of research bodies with civil society groups and the wider public'.[69] The project that was financed under this Call was PERARES,[70] with the objective 'to strengthen public engagement in research (PER) by involving researchers and Civil Society Organizations (CSOs) in the formulation of research agendas and the research process'. The project gives CSOs a stake in the dialogue, as their research requests are put on the research agendas of Science Shops.[71] The PERARES project has functioned as a pilot for a new

[68] See www.mio-ecsde.org/_uploaded_files/nanovirtualium/.

[69] SiS-2009-1.2.1.1 Structuring Public Engagement in Research (PER), in Science in Society Work Programme 2009, ftp://ftp.cordis.europa.eu/pub/fp7/docs/wp/capacities/sis/s_wp_200903_en.pdf, last visited 13 August 2012.

[70] PERARES: Public Engagement with Research and Research Engagement with Society, www.livingknowledge.org/livingknowledge/perares, last visited 13 August 2012.

[71] Science Shops provide independent and participatory research support in response to concerns raised by civil society (www.livingknowledge.org). Often they are university-based, with CSOs coming to them to ask research questions that can be taken up by students under faculty supervision as part of their curriculum. This allows such infrastructure to be affordable (often even free) to CSOs. The bridging work done by Science Shop staff creates a win-win situation, in which students can learn, CSOs are empowered, faculty deals with interesting cases and the institute develops a good regional

format in the Science in Society Programme: the Mobilisation and Mutual Learning Networks (MMLs).[72] In these MMLs, actors from various backgrounds work together as partners in all phases of the research and innovation process to tackle one of the Grand Societal Challenges. Budgets are of the order of EUR 4 million, and a minimum of 10 partners is required.

In mid-2012, negotiations were underway for the successor to FP7, Horizon 2020, and at the time of writing the position of SiS in H2020 is still unclear. However, H2020 emphasizes 'responsible research and innovation',[73] which implies the active involvement of civil society actors as new stakeholders in discussing and managing NEST. This will imply learning-by-doing and a de facto broadening of the development of NEST.

Clearly, these developments will create an increased role for CSOs in newly emerging science and technology. Does this constitute an extension of the public sphere? The answer to this question depends on whether there are indications of an increased competence to engage in critical discussion about NEST, and an emerging repertoire that can be drawn on, as well as the occurrence of spaces for interaction that are linked. I noted the ambiguity of capacity-building in that its importance is argued in terms of the goal of inclusive governance, which implies an extended public sphere, while in practice the need for capacity-building implicitly postpones the involvement of CSOs, which reduces opportunities for learning-by-doing. Capacity-building remains important, but for it to contribute to an extension of the public sphere other dimensions of capacity apart from becoming knowledgeable about the new technology and its issues are important. One can think of competences to critically reflect on the nature and value of new technological developments. The

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image. Examples within the nano-domain are an early request to receive documentation on nanotechnologies by an umbrella organization for environment and health, an MA thesis in Law on the topic of producer liability for nano products commissioned by an environmental organization, and the study of the toxicology of a specific nanoparticle commissioned by the same organization (Mulder, personal communication 07-11-2012).

[72] <http://ec.europa.eu/research/science-society/document_library/pdf_06/mobilisation-mutual-learning-work-programme-2012_en.pdf>, last visited 13 Aug 2012.

[73] 'With the aim of deepening the relationship between science and society and reinforcing public confidence in science, Horizon 2020 should favour an informed engagement of citizens and civil society on research and innovation matters by promoting science education, by making scientific knowledge more accessible, by developing responsible research and innovation agendas that meet citizens' and civil society's concerns and expectations and by facilitating their participation in Horizon 2020 activities'. From European Commission (2011): Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020), <http://ec.europa.eu/research/horizon2020/pdf/proposals/proposal_for_a_regulation_of_the_european_parliament_and_of_the_council_establishing_horizon_2020_-_the_framework_programme_for_research_and_innovation_(2014-2020).pdf#view=fit&pagemode=none>, last visited 14 Aug 2012.

experiences in the NanoCap project suggest that CSOs, also because lack of resources, will not invest in such learning, but rely on their traditional roles when engaging with newly emerging science and technology. The reluctance of CSOs and nanotechnology developers to engage in public-sphere type interactions, as was visible in the company visit and in the closing event, can be seen as an effect of the conditions of this particular space for assembly, where learning about newly emerging nanotechnology by CSOs was the primary aim (thus communication as transmission – from the world of nanotechnology to civil society – was sufficient). However, it also relates to a long-standing concern of CSOs to not wish to be co-responsible for the outcomes of deliberation and negotiation processes, in other words to protect themselves from co-optation by other types of actors (see the dynamics of INRA's co-construction project described in Chapter 3). Such a positioning has repercussions for the extension of the public sphere. Therefore, I will return to this issue in Chapter 7.

Chapter 5 Dutch Societal Dialogue on Nanotechnology

Introduction

The two previous chapters primarily focused on interaction processes in local topical spaces. In each chapter I situated the space in a broader context and indicated whether and how public-sphere type interactions had occurred. In this chapter, an empirical site with an explicit multilevel structure will be studied. The Societal Dialogue was an attempt by the Dutch government to open up its policymaking process on newly emerging nanotechnology to bottom-up input from stakeholders and interested citizens, with the aim of identifying ethical and societal issues that are currently not being taken up by existing institutions (Ministerial Resolution on Implementation, 2009). The actual design of the space for interaction was delegated to a Committee, within bounds specified in its mandate. The Committee itself was not a partner in the interactions (except for a few ad-hoc meetings), but enabled a variety of local spaces for interaction by funding proposals for the organization of numerous activities in society where stakeholders and citizens could learn about technology and share their views, values and dilemmas related to nanotechnology and its societal and ethical aspects. It is interesting to study this multilevel constellation of interactions because the set up of the Societal Dialogue can be seen (and some of the Committee members thought in such terms) as an attempt to extend the public sphere in Dutch society by enabling opportunities to gain experience in and build competences for deliberation on newly emerging nanotechnology.

Involving citizens in societal dialogues on NEST

The Dutch Societal Dialogue was not unique. A number of governments in Western Europe (Germany and France, in addition to the Netherlands) have addressed the challenge of the acceptance of new technology such as nanotechnology by organizing or commissioning national societal dialogues. While public engagement events might be small-scale, even one-day events, societal dialogues are ambitious attempts to create larger scale, longer term interactions. Societal dialogues link to citizens in society, that is part of the definition. Moreover, there is an immediate link to national government in the fact that it initiates the societal dialogue and is thus expected to do something with the outcomes. Such societal dialogues are not new in the Netherlands: there was a societal dialogue on

nuclear energy in the mid-1980s, and another such dialogue on biotechnology and food in the early 2000s (Van Est et al., 2002). What was new was that the societal dialogue on nanotechnology, in the Netherlands and elsewhere, was organized at an early stage of development of the technology, with its high degree of uncertainty, unpredictability and unknowns. Which promises will be taken up, how novelties will materialize in society and what the impacts might be is not yet clear.

How societal dialogues are designed and orchestrated influences how citizens can become engaged and if and how outcomes can be taken up. In Germany, the emphasis of the societal dialogue on nanotechnology was on stakeholder interactions, with the aim to advise ministries and federal authorities on the potential benefits of nanotechnology and uncertainties and knowledge gaps with regard to risks and safety issues (Pfersdorf, 2012). Citizens were involved, but only through civil society organizations. In France, one of the main aims of the debate was to discuss which options or nanotechnology trajectories the government should invest in. There was a strong top-down set up implemented by the CNDP.[74] The societal debate was largely a failure with respect to public involvement. The top-down orchestration was contested, leading to the disruption of meetings (Doridot, 2010). In response, the organizers decided to re-orchestrate already scheduled meetings and sometimes chose to separate nano-experts and publics, or cancel meetings altogether.[75]

In the Netherlands, the societal dialogue was initiated by the Dutch government with the aim of gaining input for its policy on nanotechnology (Parliamentary Documents, 2008). The Dutch Societal Dialogue on Nanotechnology was organized as a multilevel constellation, with a bottom-up component, consisting of small projects that had to stimulate dialogue between different types of actors (micro-level). It was part of the government's Action Plan on Nanotechnology (macro-level) and was shaped and organized by an independent committee (meso-level). It has been successful on its own terms, but, as I will show in this chapter, these terms did not cover the full breadth of the original aims set by the Dutch government.

[74] The Comité National des Debats Publics: a government agency that is responsible for organizing public debates and public participation on societal processes and projects in France (e.g. on the planned construction of motorways, power lines and railways) www.debatpublic.fr/index.html.

[75] For more information on the design, orchestration and outcomes of the French public debate, see (Doridot, 2010) www.egaisproject.eu/sites/default/files/documents/Darmstadt_2010_EGAIS_Doridot.pdf.

Aim of the chapter

By studying the Dutch Societal Dialogue I can gain insight into the enabling and constraining conditions with regard to interaction processes in an explicit multilevel constellation: the project leaders had to develop their project proposals to stimulate deliberation between nanotechnology developers and civil society actors within the call for proposals as developed by the Committee; the Committee, in turn, relied on the results of the individual projects to write its midterm and final reports, with the final report then serving as input for policymaking by the government. The purpose of this chapter is not to evaluate the work of the government and Committee, or the individual projects in detail. My aim is to focus on interactions at various levels. For example how interactivity between nanotechnology developers and civil society actors was stimulated in actual dialogue initiatives, how a committee made up of members with different backgrounds and stakes had to come to agreements, for example about what should be included in the official reports, and how outcomes of the individual projects became visible at the collective level, for example in publicly available websites, documents and newspapers, so that other actors in different contexts could, in principle, continue the debate. Given the mandate of the Committee, a further question concerns whether and how ethical and societal issues were inquired into and articulated at the micro-level and taken up at the meso-level (the Committee) and macro-level (Dutch government).

Data collection

The data collection was oriented to the identification of the strategies and activities developed at each level, and an analysis of the mutual interactions between activities at the different levels. To gain insight in activities and considerations of the Dutch government (macro-level), I held an interview with a policy maker who monitored the Societal Dialogue, and I analysed Dutch policy documents on the governance of nanotechnology (produced between 2006 and 2011). I examined the rationales for the establishment of the Dutch Societal Dialogue, as well as the question if and how insights produced within the Dutch Societal Dialogue were taken up in official policy considerations. Observation of four Committee meetings and four public meetings organized by the Committee (meso-level) and document analysis of publicly available progress reports (see www.nanopodium.nl) provided insight into how the Committee took up its mandate, negotiated what was at stake and what should be done, and how it aggregated results from the individual

projects in its midterm and final reports.[76] Moreover, I was a project leader myself and had to complete bi-monthly progress reports, which allowed me a participant's insight into what the Committee found important and how it wanted to operationalize its mandate of organizing a societal dialogue on 'pressing ethical and societal issues' (Ministerial Resolution on Implementation, 2009). To gain insight into deliberation processes that occurred in the actual spaces for interaction that were set up (micro- level), and to analyse whether and how broader ethical and societal issues were articulated, I studied the projects funded. This was done by examining the reports of the respective project leaders, as well as by examining PR material, websites and video recordings of debates (available at www.nanopodium.nl). I was also present as a participant observer in a number of activities organized by different project leaders. In Section 5.3, I will specify the methodological approach that I took to study the individual projects.

All the quotes from the interviews were authorized by the interviewees. Their translation and interpretation are mine.

Section 5.1 Design and orchestration of the National Dialogue

An amount of EUR 4.5 million was made available by the Dutch government for the Societal Dialogue on Nanotechnology. In preparing for it, the Dutch government commissioned an independent Committee to design and orchestrate the Societal Dialogue. The Committee was asked to ensure that there would be something at stake in the Societal Dialogue: the Societal Dialogue should focus on identifying themes and issues, in particular ethical and societal issues, that currently are not taken up by existing institutions (Ministerial Resolution on Implementation, 2009; Parliamentary Documents, 2008). As I will show, the Committee operationalized its mandate in a potentially promising design, but as the Societal Dialogue proceeded, the original mandate became sidelined. Below, I will start by providing some context to show how the Societal Dialogue was embedded in a broader governance approach to managing newly emerging nanotechnology in the Netherlands.

After some early initiatives by the Rathenau Institute (Van Est, Malsch, & Rip, 2004), the Dutch government asked for advice about the risks of nanotechnology from the Dutch Health Council

[76] These were the opening ceremony of the Dutch Societal Dialogue in 2009 in The Hague (CIEMD, 2009), the closing event of the Societal Dialogue in Nemo (the science museum) 2011 (CIEMD, 2011), and two meetings organized by the Committee for project leaders to meet one another and hear more about the different projects.

(Health Council of The Netherlands, 2006) and about policy on nanotechnology generally from the Royal Netherlands Academy of Arts and Sciences (KNAW) (Royal Netherlands Academy of Arts and Sciences, 2004). The Dutch government then decided to develop a Vision Document for the governance of nanotechnology (Parliamentary Documents, 2006) and in 2008 proposed a twofold strategy to address nanotechnology in society (Parliamentary Documents, 2008). The proposal was to approach risk and safety issues (e.g. toxicity of synthetic nanoparticles) and 'broader ethical and societal issues' in different ways. With regard to the latter, a societal dialogue with 'citizens' and 'stakeholders' was proposed to identify and map pressing ethical and societal issues which had not yet been taken up by other institutions. The document offered examples of such issues: in the field of new medical devices, for example, issues such as the integrity of the human body, the manipulability of human beings and human dignity were mentioned. The potential of nanotechnologies to increase the current gap between developed and developing countries was also mentioned with respect to the distribution of wealth.

To identify risks to human health and the environment, a *Klankbordgroep* (Sounding Board) with representatives from industry, science and environmental organizations was established in 2008. In the 2006 Vision Document, the government reflected on its past experiences with societal dialogues and on public engagement activities on nanotechnology in Germany and the UK, and on this basis articulated lessons and design requirements for the creation of a fruitful societal dialogue on newly emerging technology. It recognized that:

> *'Providing only information and education on nanotechnology is not enough to gain societal acceptance.'* (Parliamentary Documents, 2006, p. 28)

Thus, a societal dialogue should provide opportunities for citizens to articulate their concerns and opinions and identify pressing issues. The government committed itself, to a certain extent, to the outcomes of the societal dialogue by stating:

> *'The opinion of Dutch citizens matters (...) Societal acceptance can only be established when input from citizens is used to shape R&D trajectories and risk evaluations.'* (Parliamentary Documents, 2006, p. 28, 29)

At the same time, the Dutch government also made explicit that the societal dialogue would not be the sole source of policy development.

Given the criticism the Dutch government had received earlier of being too biased in favour of GM products during the societal dialogue on GM and food, this time it did not want to play an active role in the societal dialogue itself. Its aim was to keep 'the dialogue and its own position as clear and unencumbered' as possible (Ministerial Resolution on Implementation, 2009). Therefore, the Dutch government delegated the design and orchestration to an independent Committee and wanted to keep distance to the work of the Committee.

The mandate of the Committee was to develop a strategy that would bring 'focus' and 'concreteness' to the Societal Dialogue (Ministerial Resolution on Implementation, 2009, p. 3). First, the Committee had to develop, in cooperation with stakeholders from science, industry and civil society organizations, a priority list (called 'public agenda') of ethical and societal issues that should be discussed in the Societal Dialogue. This priority list was also to be linked to concrete developments in and applications of nanotechnology.

Second, based on that priority list, the Committee had to stimulate and facilitate the Societal Dialogue. How this would be done was left largely to the Committee to determine. What the government did emphasize was that the primary focus of the Committee should be on stakeholders, but interested citizens should also have the opportunity to participate in the Societal Dialogue. In addition, the government noted that the Committee should approach and stimulate stakeholders and interested citizens in different ways in order for them to be able to develop their own dialogue activities. Furthermore, the Committee had to produce publicly available midterm and final reports about the progress and the results of the Societal Dialogue (Ministerial Resolution on Implementation, 2009).

Section 5.2 The Committee and its work

The Committee had freedom to determining the details of its generic mandate and could thus decide whether to follow the various suggestions or not. Thus, the selection of Committee members was a challenge: its composition had to convey societal legitimacy, while the government wanted to be assured it would do a good job.[77]

[77] A temporary interdepartmental working group of the government prepared the selection of Committee members. The interdepartmental working group indicated that the Committee members had to have an affinity with different groups in society that were active around the development and embedding of nanotechnology or new and emerging technologies in

To prepare for the Dialogue, the Committee developed activities to give further substance to its mandate. Together with its secretariat, the Committee conducted a stakeholder meeting, as was proposed by the government.[78] It also took the initiative to conduct a survey, as a baseline measurement to determine the level of knowledge among Dutch citizens about nanotechnology and its possible application areas, such as nano-electronics, nanotechnology in healthcare and nanotechnology in consumer products. There were focus groups and an online survey. The baseline measurement showed that Dutch citizens had a low level of awareness of nanotechnology and its products. Together with the outcomes of the stakeholder meeting, this result led the Committee to develop particular design requirements which, together with the priority list of ethical and societal issues, were specified in the call for project proposals (CIEMD, 2009).

Call for proposals

In the call for proposals, the Committee tried to refine and concretize the Societal Dialogue by specifying five application areas of nanotechnology and by articulating the possible associated ethical and societal issues. The five application areas the Committee identified were 'wellbeing, food and healthcare'; 'environment and sustainability'; 'safety and privacy'; 'international relations'; and 'sustainable economic growth'. Possible issues for discussion that were identified by the Committee included 'Who or what institution can be held liable in the event of nanotechnology and nanoparticles causing harm to human health?', 'What kind of information does the consumer need and how should information be provided to consumers?', 'How can nanotechnology contribute to more sustainable energy?', and 'How can nanotechnology provide alternatives to animal testing?' (for all issues identified by the Committee, see call for proposals (CIEMD, 2009, p. 8).

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general. The nine members that were appointed to form the Committee had backgrounds in nanoscience and technology, ethics, STS, toxicology and health policy. The Chair of the Committee had a background in economics and had been the president of a national research funding agency.

[78] Representatives from industry, science, civil society organizations and scholars in the field of science and technology studies from Belgium were also present. The latter had organized public engagement activities on nanotechnology in Belgium. This stakeholder meeting was set up to develop the priority list and answer the questions defined by the Committee: 1) What are the main topics, questions and uncertainties in the field of nanoscience and technology? and 2) What are fruitful dialogue processes?

In order to establish a dialogue with citizens who had a low level of awareness, the Committee proposed a two-stage approach. The first phase of the Societal Dialogue would focus on providing information and raising awareness (with the help of TV programmes, brochures, websites) about nanotechnology and ethical and societal issues.[79] In the second phase, a dialogue would be initiated based on insights from phase one (CIEMD, 2009). The activities mentioned by the Committee were science cafés, panel discussions, one-on-one interviews, and theatre performances followed by discussion sessions. The invitation to submit proposals was made known by extended publicity in newspapers, television commercials and in an official kick-off meeting. Project proposals had to be submitted within 20 days of the official kick-off meeting.

Salient in the call for proposals was the Committee's primary focus on the citizen as lay person who needs to become acquainted with nanotechnology, thus less on stakeholders, as had been the suggestion of the Dutch government. Actors such as companies, research institutes and government agencies were mentioned in the call for proposals, but they were positioned by the Committee as actors that could take up the outcomes of the Societal Dialogue (CIEMD, 2009, p. 5), and not as active dialogue partners who had to inquire into nanotechnology developments and articulate ethical and societal issues.[80]

Every Dutch citizen and organization could propose activities. The Committee explicitly encouraged CSOs to submit proposals and participate in the Dialogue (CIEMD, 2011, p. 28). Committee members and the secretariat proactively approached CSOs. The argument was, as stated by the Chair, the secretariat and some Committee members, that having CSOs involved as early as possible in the dialogue, would prevent the situation that occurred with GM, namely that the societal dialogue started too late and that the content was too biased. With the Societal Dialogue on Nanotechnology, CSOs were thus offered the opportunity to participate during the early stages of the technology's development, and to articulate their points of view. Another reason for the Committee proactively approaching CSOs was the expectation that, in general, CSOs have quite a number of followers. This would guarantee outreach of their projects (interview Secretariat, March 2011). The Committee, however, did articulate some prerequisites for CSO participation, on which I will elaborate below.

[79] This could be seen as a form of 'capacity building', see Chapter 4.

[80] This focus on citizens was already visible in the preparation phase when the Committee conducted the baseline measurement.

Developing selection and evaluation criteria

Over time, the strategy of the Committee to first focus on providing information and raising awareness on nanotechnology and its broader ethical and societal issues and then stimulate an informed dialogue, shifted towards providing information and awareness building as the main priority, operationalized as outreach, even if not all Committee members were happy with this move. The Chair of the Committee positioned himself as the 'process manager' of the Societal Dialogue and strongly advocated this focus. In an interview for ObservatoryNANO (Malsch, 2011), the Chair described what the aim of the Societal Dialogue should be and what his role and responsibility was:

> *'Government, but also other stakeholders, including industry, should be kept at quite some distance. The debate itself, but also the contents of the dialogue, should be determined by society. No-one should hold the steering wheel, except society itself (…) I had to play a passive role and not express an opinion on nano. I was just a process manager.'* (ObservatoryNANO, 2011, p. 2, 8)

During Committee meetings there were discussions among the members and the secretariat on how to define and measure the scope of projects, but most of the Committee members did not challenge the focus on outreach and knowledge transfer. Some Committee members wanted to pursue a more reflexive approach in the Societal Dialogue and, according to them, the main challenge was to define a meaningful Societal Dialogue. During a discussion among Committee members about how to visualize the outreach of the individual projects, one of the Committee members stated:

> *'The focus on numbers makes me feel uncomfortable. We should be more creative; what do we intend to have by 2011? For me, it should be more than tables and graphs. I do not want to say that it is easy, but I do want to show that a public dialogue cannot be captured in numbers and tables only.'*
> (translation by author)[81]

The focus on outreach became particularly visible during the selection and monitoring of the individual projects. In total, the Committee received around 120 proposals. Seventy submissions

[81] Committee members who wanted to pursue a more reflexive approach took the initiative to organize an international workshop with international STS scholars and representatives from four European countries that were involved in organizing national public engagement events on nanotechnology (UK, France, Norway, Ireland). The workshop was centred around the question: How do we create a fruitful societal dialogue on nanotechnology?, with the sub-questions: How do we discuss a technology that is not 'there yet'? How do we take up the outcomes of a societal dialogue in a neoliberal representative democracy? How do we involve the public? Who should define the content of a societal dialogue?

were asked to send in full proposals. In the final stage, 35 projects were selected. The Committee had two important selection criteria: the distribution of selected proposals over the five themes, and sufficient outreach for each project (CIEMD, 2011). The main feedback that the Committee gave to the project leaders who were asked to submit full proposals was to increase outreach and/or find a more balanced approach (i.e. pay attention to both positive and negative aspects) (interview Secretariat, March 2011). For example, one Dutch environmental organization which submitted a project proposal in the first round of the Societal Dialogue proposed identifying the possible risks of nanoparticles in cosmetics. According to this CSO, risk and safety issues did not receive enough attention in current policymaking on nanotechnology. In order to attract the attention of policymakers (and the media), their initial proposal was to have naked women carrying nano-cosmetics at the Binnenhof in The Hague, where the Dutch parliament is seated. The Committee members rejected this proposal, as explained by a Committee member:

> *'There was a consensus, at least with eight of us, that the best way to proceed with the Societal Dialogue is to refrain from public displays that might be too controversial. The Committee clearly preferred reasoned discussions over heated debates.' (interview with Committee member 09-03-2010)*

During the first round of proposals, the project proposals by CSOs (which were few) were not funded because they were all evaluated as being of 'lesser quality' than other proposals, mainly because the CSO proposals failed to present a 'balanced view' on the pros and cons of nanotechnology (interview with Chair and secretariat 18-1-2010). However, to stimulate the participation of CSOs in the Dutch Societal Dialogue, the secretariat and some Committee members proactively approached CSOs and offered them guidelines on how to submit good proposals for the second round of funding. The secretariat did not approach scientists and companies to submit proposals. In their opinion 'scientists at least would be approached by project leaders to join activities' (interview Secretariat, March 2013).[82]

[82] In addition, the very short deadline to submit proposals (20 days) did not seem to allow new consortia and partnerships to be built. It led to all kinds of practical problems, such as acquiring all the signatures of partners and budget clearance in time (even in fully professional organizations). For example, a project proposal by the umbrella organization for Health and Environment tried to partner with some universities, but time was too short to turn this into a coherent proposal. Also, an expert from a Dutch chemical company stated during a meeting of the Sounding Board that they had the intention to participate, but due to the short period of time, they were unable to get the right people in place.

Apart from the Dutch association of manufacturers and importers of cosmetics (NCV) and NanoHouse,[83] no developers of nanotechnology submitted a project proposal. According to a nano-industrialist who participated in the Sounding Board on the Risks of Nanotechnology:

> *'The Societal Dialogue is about nanoparticles. We do not use nanoparticles, so there is no reason for us to submit a proposal.'*

Monitoring of projects

The secretariat, assisted by Committee members, kept in close contact with the projects, and bi-monthly progress reports were required.[84] The items to be addressed in the progress reports indicate what the Committee found important and wanted to be implemented. Project leaders had to indicate the outreach of their project (how many people were reached, directly and indirectly), how much media attention they received, how much publicity they created and by which means. Remarkably, there was no direct question about which 'ethical and societal issues' were discussed and in what way. One could say that the Committee interpreted the mandate it had (to approach and stimulate stakeholders and interested citizens to conduct dialogue activities) as maintaining a distance from the content and focusing on managing the process. In the final evaluation forms for each project, the Committee did request project leaders to describe which themes were discussed and in what way. However, the response was uneven, because it was up to each project leader to determine how much effort he or she was willing to put into this report.[85] At the same time, the

[83] NanoHouse positions itself as a knowledge broker and actively stimulates the implementation of nano-based materials, products and applications by actively stimulating open innovation projects by governments, knowledge institutes and enterprises. For more details see www.nanohouse.nl.

[84] In the bi-monthly progress reports three questions related to project management (planning, cooperation with other projects, finance) had to be addressed, three on outreach (direct outreach, in terms of the numbers of people reached in the project activities; indirect outreach, through an overview of media attention; and an overview of media communication plans and ways to reach out to the general public for the next two months) and one question on 'findings relevant to the Societal Dialogue on Nanotechnology and suggestions for new or further possibilities' had to be addressed. These questions concerned processes. Questions that were particularly aimed at elucidating content were not part of the progress reports.

[85] That the response was uneven can be seen from the summaries that the Rathenau Institute made of the final reports of the projects (Hanssen et al., 2011). Some give a detailed description of the set up of the project and describe the content of the interactions, others only mention generalities. I have seen four original final reports; these varied from a few pages, up to detailed descriptions and excerpts of interaction processes.

progress reports and final evaluation by the project leaders served as the main input for the midterm and final report of the Committee.

Section 5.3 The projects

A variety of interaction spaces (see Table 1) were organized with the aim of providing information and raising awareness on nanotechnology and its ethical and societal aspects (first round of the Societal Dialogue) and, subsequently, stimulating an informed dialogue using insights and materials from the projects undertaken in the first round. The Table below shows the number of projects in each of the categories used by the Committee.

Table 1

TV programmes for a broad audience	**Publications for a broad audience**	**Activities for high school students**	**Activities for youngsters**	**Science cafés, debates and discussion**	**Other**
3	3	8	3	11	7

The individual projects that were selected ranged from a TV programme, the development of educational materials, a special issue of a popular science magazine, to science cafés, internet polls, stakeholder workshops and the development of vignettes and scenarios about the co-evolution of nanotechnology and morality. The project leaders were mainly intermediaries with a professional background in bridging technology and society, either as a science communicator (for magazines, museums, or science cafés) or as a researcher in the field of science and technology studies). There were also project leaders working in educational settings.[86] Five civil society organizations saw their proposals accepted: three environmental organizations (WECF, Stichting Natuur&Milieu, Krant van de aarde), a consumer group (Consumentenbond) and the Dutch Society against animal testing (Proefdiervrij). Finally, two developers and promoters of nanotechnology (NCV, NanoHouse) conducted projects.

[86] I gained insight into the backgrounds of the individual project leaders because they were present at two meetings that the Committee organized specifically for project leaders to meet each other and to initiate, where possible, collaborations.

Interaction processes in the interaction spaces

In this section I will analyse the kind of interaction processes that occurred in the 35 local spaces for interaction that were designed and orchestrated by individual project leaders. I did not analyse the interaction processes in terms of public-sphere type interactions. The notion of public-sphere type interactions developed in Chapters 1 and 2 concerns interactions between actors with institutionalized mandates to develop and embed nanotechnology and civil society actors. Some of the local projects organized within the Dutch Societal Dialogue were, from the outset, developed to realize 'communication as transmission' from the world of nanotechnology to society at large. Other projects were exclusively focused on realizing interactions between citizens alone. Classifying these types of projects into the Table developed in Chapter 2 is thus not worthwhile. In order to analyse interaction processes, I used the proxy indicators of 'communication as transmission' and 'communication as transaction' (Hanssen, 2009). The occurrence of communication as transaction is an indication of the occurrence of public-sphere type interactions.

To classify the projects, I followed the distinction made by the Committee between projects that were aimed to provide information and projects that were aimed to stimulate a dialogue between different actors about meanings, values and consequences of newly emerging nanotechnology for society.

Table 2 provides an overview of the interaction format and content of the individual projects. I analysed how and what kind of information was provided (communication as transmission), and whether and how the individual projects offered occasions for nanotechnology developers and civil society actors to assemble and share visions, values and dilemmas in relation to nanotechnology and its ethical and societal aspects (communication as transaction). I conducted this analysis on projects that aimed to organize face-to-face or online interactions, as well as on projects that were aimed to develop materials; for example, films, vignettes (that is, short written narratives), educational material and brochures. I studied whether and how the materials paid attention to the visions and dilemmas expressed by technology developers as well as civil society actors.

The differentiation between 'broader ethical and societal issues' and 'risk issues' is not straightforward and making such a distinction sometimes reduces the complexity of the actual approaches (for example, some projects used a combination). My practical solution was to follow the way in which the Committee and the Dutch government differentiated between these two

categories, and I added the criteria mentioned by Swierstra & Te Molder (2012) and Hanssen (2009, 2011). These authors differentiate between traditional promises and risk discourse, and broader ethical and societal aspects. The former cluster of issues refers to economic benefits, toxicology, labelling and precaution, the latter cluster includes broader issues such as shifts between dichotomies such as natural-artificial, public-private and responsible-irresponsible as a result of new technologies; changing societal values, norms, relations; and the governance of nanotechnology (e.g. new distribution of roles, responsibilities and mandates). In order to classify the projects in relation to one of these dimensions, I examined which of the topics (risks/benefits or broader ethical and societal issues) were at the forefront in each of the projects.

The sources used were the project summaries as published on the Nanopodium website and PR material developed by each project leader. In addition, I used descriptions of the projects by the Rathenau Institute (Hanssen et al., 2011).[87] My aim was not to reconstruct what happened in detail, but to obtain a general picture. An analysis of the two categories of communication and the type of issues addressed was also done by a colleague. For project 17, we could not reach a consensus, so it was not included in Table 2.

[87] Projects 14 and 15 are not included in Table 2 because there was too little information available to assess them. Projects 2 and 25 included several subprojects which are numbered separately.

Table 2

	Communication as transmission	**Communication as transaction**	**Main focus on risk, safety and cost-benefits discourse**	**Main focus on broader ethical and societal aspects**
Projects that delivered material (e.g. brochures, vignettes, film, websites)	1, 2(A), 3, 4, 7, 8, 13, 16, 19, 30, 31, 33, 35	6, 18, 29, 25A, 34	1, 2(A), 3, 4, 6, 8, 13, 16, 19, 30, 33, 34	7, 18, 29, 31, 35, 25A
Projects that organized face-to-face or online interactions between technology developers and civil society actors	2(debate), 9, 21, 28, 25B	20, 24, 25C	2 (debate), 21, 28	9, 20, 22, 24, 25BC
Projects that organized face-to-face or online interactions between citizens	10, 11	5, 12, 22, 23, 26, 27, 32	10, 11, 23	5, 12, 22, 26, 27, 32

Legend: 1 = I know Nano: Nano in beeld (I know Nano: Nano in the Picture); 2 = Nanotechnologie in Macroperspectief (Nanotechnology in Macroperspective) (2A = TV programme 'Labyrint'; 2B = debate); 3 = Proefdiervrij (No Animal Testing); 4 = Quest (a popular science magazine); 5 = Het grote Nano-Onderzoek (The Big Nano Survey); 6 = Vrouwen en Cosmetica (Women and Cosmetics); 7 = Mag wat kan? (What is acceptable?); 8 = Klein, kleiner, Groots; (Small, smaller, Great); 9 = I know nano: Nano en onderwijs (I know Nano: Nano and Education); 10 = NanoLinx; 11 = Nano Society; 12 = Theaterdebat 'Nano is groot' (high school students) (Theatre debate: Nano is big); 13 = Nanotrivia; 14 = Mijn nanotoekomst (My nano future); 15 = NanoVideo Hunt; 16 = LLowlab; 17 = Nano Theatersport; 18 = *Beweging* (popular philosophical journal of the Foundation for Christian Philosophy); 19 = Nanodiscussie Online (nano discussion online); 20 = Gezamenlijk leren (Mutual learning); 21 = Nanokaravaan (Nano-caravan: Science Cafés); 22 = Theaterdebat 'Nano is Groot' (General public) (Theatre debate Nano is big); 23 = Internet panel Nanotechnologie; 24 = Nanotopia; 25 = Nanorecht en Vrede (Nano justice and peace); 25A = materials; 25B = two web seminars; 25C = two conferences); 26 = Interreligieuze dialoog Nanotechnologie

(Interreligious dialogue nanotechnology); 27 = Nano. Geloven in het Kleine (Nano. Believing in the small); 28 = Consument en Nanotechnologie (consumers and nanotechnology); 29 = Vignettes and Scenarios; 30 = Next Nature: nano; 31 = Kunst van Nanotechnologie (Art of Nanotechnology); 32 = De contrastenconferentie (Conference of Contrasts); 33 = Base Camp nano; 34 = Nano interviews in de babykamer (Nano Interviews in the Baby Room); 35 = NanoTube

Table 2 provides an overview of all the projects. In the Tables below, the data is clustered along two dimensions: communication as transmission versus communication as transaction; and risk versus broader ethical and societal aspects. This allowed me to analyse the data from Table 2.

Table 3: Projects focusing on producing materials (thus, almost by definition communication as transmission)

Communication as / Issues addressed	Transmission	Transaction
Risk, etc.	1, 2(A), 3, 4, 8, 13, 16, 19, 30, 33	6, 7, 34
Broader ethical and social aspects	31, 35	18, 25A, 29

Table 4: Projects aiming to stimulate interaction between actors involved in the development of nanotechnology and civil society actors

Communication as / Issues addressed	Transmission	Transaction
Risk, etc.	2B, 21, 28	
Broader ethical and social aspects	9, 25B	20, 24, 25C

Table 5: Projects aiming to stimulate interaction between citizens

Communication as / Issues addressed	Transmission	Transaction
Risk, etc.	10, 11	23
Broader ethical and social aspects		5, 12, 22, 26, 27, 32

The second and third types of projects cluster on the main diagonal. One comment that can be made is that citizens are clearly seen as not knowledgeable about risks. They are concerned (or project leaders expected them to be concerned) and are offered information. While broader ethical and societal issues lend themselves to communication as transaction between technology developers and civil society actors, during the actual projects, communication as transaction primarily occurred between citizens, and not in interaction with technology developers. In other words, the standard repertoire from Chapter 1 about the division of labour that is visible in upstream engagement activities was reproduced by the majority of project leaders in designing and orchestrating the local spaces for assembly.[88] Even so, as the bottom right cell of the second matrix shows, there are openings, in other words, there were projects in which communication as transaction between technology developers and civil society actors was realized. The design and orchestration of these projects will be described below. A further observation is that the correlation between risk/transmission and broader ethical and societal issues/transaction is strong, both for nanotechnology developers/civil society interactions and citizen interactions. Thus, the standard repertoire has effects, whether developers and promoters of nanotechnology are involved or not. Below, for each category, I will single out a few projects and describe their design and content.

Projects providing materials

Eighteen of the projects in Table 2 aimed to raise awareness and stimulate dialogue by providing materials, for example, educational materials (7, 8), vignettes and scenarios (29), TV programmes (1, 2), and brochures (4, 18). These are listed separately in Table 3. The majority focused on providing information from the world of nanotechnology to society, highlighting the promises, as well as possible risk and safety issues. For example, a TV programme for a broad audience called 'I know Nano: Nano in Beeld' (Nano in the Picture), developed five episodes on the pros and cons of nanotechnology. In each episode, an enactor of nanotechnology highlighted the promise of nanotechnology, for example for filtration or energy, and afterwards the interviewer asked 'is it safe'? *Quest* (4), a Dutch popular science magazine, published a special issue on nanotechnology for a broad audience, highlighting the historical evolution of nanotechnology and the benefits of nanotechnology applications for society (www.quest.nl). A project of the Dutch foundation Krant van

[88] With the 'standard repertoire' I refer to the division of labour visible in upstream engagement activities: technology developers are not expected to point out societal issues or concerns, which is the responsibility of others, of civil society actors. Actors involved in the development of nanotechnology are expected to provide information.

de Aarde called ‘Klein, kleiner, Groots!’ (8) developed a brochure for high-school students to raise awareness on nanotechnology. The main focus was on explaining what nanotechnology ‘is’ (e.g. What does a nanoparticle look like? What is the difference between nanoscience and nanotechnology?) (www.krantvandeaarde.nl/pdf/brochure_nanotechnologie.pdf).

There were also projects that facilitated communication as transaction through the production of materials; for example, by creating websites that offered an opportunity for visitors to gain insight into different, and sometimes conflicting, stakes and opinions present in society in relation to the development of nanosciences and nanotechnologies, as well as allowing them to articulate their own visions and stakes via a special ‘discussion forum’ (6). A civil society organization, WECF (Women in Europe for a Common Future), organized a project focused on the role of retailers in managing risks related to the market introduction of nanoconsumer products for children. Their website contains short movies in which actors developing newly emerging nanotechnology, retailers, toxicologists and CSOs all articulate their visions, stakes and dilemmas with regard to health and environmental safety issues of nano-enabled products in child care (www.nanoeenveilignest.nl). The Dutch Society for Nature and Environment, together with the Dutch association of manufacturers and importers of cosmetics (NCV) (6), developed a digital nano-checkpoint (www.nanocontrole.nl) for cosmetics. Visitors to this website could fill in a form and check if their cosmetics contained nanoparticles and how risky that might be. Background information on risk issues was available. Although the website focused on providing information, it offered an opportunity for visitors to read about the positions and stakes of the industry (NCV) enacting newly emerging nanotechnology, as well as those of an environmental organization. There were also projects that provided material and realized communication as transaction on broader ethical and societal issues.

Philosophers from the University of Twente (29) developed vignettes and scenarios on how specific nano-enabled devices might influence and change current societal values, norms and habits in concrete situations, such as healthcare settings. Most of these vignettes were developed based on scientific and technological knowledge of certain nano developments (e.g. nanomedicine, nano and food, nano and sports). Based on the current developments, and through discussion and imagination, the philosophers created a storyline in which different worlds engage in a discussion on paper (e.g. medical doctors, health insurance companies and patients). The reader thus gains an impression of the different stakes, issues and dilemmas that may evolve. The vignettes and scenarios were available on a website, which meant that other project leaders could use it as external input to stimulate discussion. The Association of Reformational Philosophy (18) produced a special issue of

their journal on nanotechnology, which also showed communication as transaction: different stakeholders, such as nanoscientists, philosophers and a nano-industrialist articulated their stakes, visions and the dilemmas faced in the study, control and manipulation of matter at the atomic and molecular scale, and how this may or may not challenge the Creation narrative.[89]

Projects creating face-to-face or online deliberations

There were also projects that attempt to create face-to-face or online interactions between citizens, or between nanotechnology developers and civil society actors. Almost all of these projects used external input to stimulate interaction. A project called 'Interreligious Dialogue' (26) used the film 'Gattaca' (about genetic enhancement) to stimulate discussion between people with different religious backgrounds on the question of which values or convictions behind the development of nanotechnology can be considered acceptable or not. A project called 'Het Grote Nano-onderzoek' (5) (The Big Nano Survey) used the vignettes developed by the University of Twente (29) to develop propositions for their website. Visitors to the website were asked to commit themselves to participation in an online dialogue and were invited to read the vignette and discuss two or three probing questions. Two questions related to nano and healthcare were: Would you leave your diagnosis to a lab-on-a-chip? Would you like to control your medication yourself with the help of a lab-on-a-chip? I myself organized three interactive stakeholder workshops (20) on how certain nano-enabled devices in the healthcare sector, such as lab-on-a-chip technology and body-area-networks, might change the current roles, responsibilities and tasks of healthcare professionals, insurance companies, patients and scientists working in the field of nanotechnology and healthcare (see Chapter 6). Sociotechnical scenarios were developed to stimulate discussion and reflexivity on current and future roles and responsibilities.

Societal issues were inquired into and articulated in those projects that used external input and/or the explicit orchestration of interactions. For example, in the project called 'Nanotopia' (24) there was an explicit orchestration by the debate moderator, Koen Dortmans. As part of the project, a public meeting on the nano-pill was organized.[90] The focus was on how the nano-pill might change

[89] www.nanopodium.nl/CieMDN/content/Bewegingspecial_Nanotechnologie.pdf

[90] The nano-pill is currently being developed by the Mesa+ Institute at the University of Twente. It aims for the early diagnosis of intestinal cancer. The development of the nano-pill is still in the R&D phase, but prototypes have been developed. After swallowing the nano-pill, microscopic wires in the pill can detect DNA fragments from cancer cells, long

current healthcare practices, and how responsibilities might shift from healthcare professionals to patients. The invited speakers were a lab-on-a-chip scientist, the Chair of a patient organization and a general practitioner. The moderator invited the stakeholders to participate as knowledgeable actors and stimulated the participants to question each other and explore, in interaction, ethical and societal aspects of nanotechnology and its applications. The participants articulated several emerging societal issues concerning potential risk issues (e.g. What if the nano-pill does not leave the body? What are the risks for human health and the environment when the nano-pill enters waste water?), as well as the broader ethical and societal aspects such as who is responsible for treatment. The patient organization and members of the general public articulated their concerns about the use of a mobile phone in transmitting results. As the Chair of the patient organization said: 'I find screening very private. A mobile phone can be tapped. I can well imagine that a health insurer says at a certain moment "I would like to start listening in on that frequency"'; privacy should be absolutely guaranteed' (translation by author)(Krabbenborg, 2010). Issues with regard to privacy and changing roles and responsibilities due to new nano-enabled applications in healthcare were also explored and deliberated upon in an interaction workshop that I organized on the societal embedding of the lithium chip (20).[91] One of the issues that was taken up as a topic for deliberation between different types of actors was the meaning of good care in relation to treatment of people with bipolar disorder. According to one patient, a patient organization and a psychiatrist who were all present at the workshop, a lithium-chip should never replace face-to-face contact with the psychiatrist. 'Good care' implied to them that patients should be educated in how to use the chip and the psychiatrist-at-a-distance should know about the results of each measurement.

We saw that the majority of the projects were designed and orchestrated to raise awareness with regard to what nanotechnology is. Nanoscientists were provided with a stage to explain nanotechnology, including its possible risks and safety issues. In these activities civil society actors were positioned as lay persons in need of adequate information. Thus, in these projects there was no sharing of visions, values, dilemmas between nanotechnology developers and civil society actors.

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before any tumour becomes visible (www.mesaplus.nl). The idea of the developers is that the data collected by the pill should be transmitted automatically to the doctor's mobile phone. The pill itself passes through the body.

[91] The lithium chip can be used by patients with bipolar disorder who use lithium as a medicine. Currently, these patients have to go the hospital to check the level of lithium in their blood at least four or five times a year. The promise of the lithium chip is that people can monitor their lithium level, and according to the developers this will improve their quality of life because they will no longer have to travel and will be more independent from healthcare professionals. The lithium chip is still being further developed, but the first clinical pilots have been done.

While these projects offered an occasion for civil society actors to increase their factual knowledge with regard to nanotechnology, nanoscientists did not have the opportunity to gain awareness of the views, values and dilemmas articulated by civil society actors. Some other projects did give all participants the opportunity to interact, such as in stakeholder workshops and interactive panel discussions which offered the opportunity to nanotechnology developers and civil society actors to inquire into and articulate, in interaction, what was at stake and what should be done. The projects that realized communication as transaction were designed and moderated in such a way that participants were invited to share their opinions, views and dilemmas in relation to a particular topic and to question each other. The project leaders who designed these spaces for interaction were not primarily focused on outreach, but invited those who were involved in the topic that was up for discussion.

Section 5.4 From individual projects to official reports and policy documents

While broader ethical and societal issues and considerations were articulated in the projects (e.g. on good care and changing roles and responsibilities of healthcare insurers, patients and caregivers), in the official reports produced by the Committee almost no such issues were mentioned. In the final report, called 'Responsibly onwards with nanotechnology' (CIEMD, 2011), the main conclusions were: 'the knowledge of Dutch citizens increased by ten percent between 2009 and 2010'; 'Dutch citizens see opportunities, but also risks, especially within the field of nanotechnology and food' and 'Dutch citizens think transparency of information is more important than precaution'.[92] With regard to nanotechnology and health, the main conclusion was:

> *'Citizens see potential, but there should not be many side-effects and it must be safe.'* (CIEMD, 2011, p. 10)

The final report produced by the Committee served as input for the Dutch government in its development and articulation of policy considerations. In September 2011, the government published a progress report on the current state of affairs with regard to nanotechnology in the Netherlands (Parliamentary Documents, 2011). The progress report contained an explicit response to

[92] This difference in percentage, from 54% to 64%, was the result of two surveys conducted by the Committee, the baseline measurement and a survey at the end of the Dialogue, to evaluate if and how the Societal Dialogue had had any effect on the level of knowledge and attitudes of Dutch consumers (CIEMD, 2010). The same questions were asked in both surveys.

the final report by the Commission, but only to isolated items, and otherwise framed in general terms, such as:

> *'We endorse the recommendations of the Committee and we find it important that Dutch citizens should be adequately informed about developments in nanotechnology and nanoparticles.'*
> (Parliamentary Documents, 2011, p. 8) (translation by author)

Ethical and societal issues and considerations related to nanotechnology are not mentioned explicitly in the government's progress report. One of the sections in this report is entitled 'Societal questions'; however, in this section, these questions are no longer related to nanotechnology but to converging technologies in general. The government states:

> *'We recognize that NBIC convergence*[93] *leads to uncertainty and new societal questions (…) However, NBIC convergence concerns a broader development than just that of nanotechnology. The implications of NBIC are not clear yet. We are currently discussing this topic with the Rathenau Institute.'*[94] (p. 11, translation by author)

The response of the Dutch government is intriguing because of this shift. Earlier on, nanotechnology was treated as a science and technology domain in its own right, in need of a societal dialogue so as to realize a responsible governance process (Parliamentary Documents, 2008) and give citizens a voice in decision-making processes. In the progress report of September 2011, however, nanotechnology has become part of NBIC convergence and it is claimed that in this respect it is too early to anticipate societal issues. One can see this as policy learning, but also as policy forgetfulness.

While there was an aggregation of the outcomes of the individual projects, there is some irony involved in how it was done. Broader ethical and societal issues were articulated in a number of projects, but in evaluating and monitoring the projects, the Committee took recourse to a more

[93] NBIC convergence refers to the convergence of nanotechnology, biotechnology, information technologies and cognitive science.

[94] The Rathenau Institute is a Dutch organization that promotes the formation of public and political opinion on science and technology developments. It is independent and autonomous, but falls under the administrative responsibility of the Royal Netherlands Academy of Arts and Sciences (KNAW) (www.rathenau.nl).

traditional focus on outreach, media attention and knowledge increase.[95] Subsequently, the government's progress report on nanotechnology did make reference to the Dutch Societal Dialogue, but not to ethical and societal aspects, in spite of the emphasis placed on them when the government commissioned the Dialogue. How could this happen?

To begin with, certain choices available to the Committee were made possible because of its relative independence from the government. Subsequently, attention to the broader ethical and societal aspects which occurred at the project level was not taken up at higher levels. One could call this 'reverse refraction'. Refraction is a well-known effect in top-down multilevel configurations (Vickerman, 2007). The argument is that because objectives developed at the top have to be implemented at the meso- and micro-levels, and there will be miscommunication, different interpretations, time constraints and lots of strategic action, refraction occurs in the implementation of the objectives. In this case, such refraction occurred, but also in the other direction: while the ethical and societal aspects were articulated at the micro-level in the individual projects, these were not given visibility due to the particular strategies and activities of the Committee (meso-level) and government (macro-level). The Committee interpreted its mandate as 'building awareness by creating outreach' and 'only managing the processes'.[96] For their midterm and final reports, the Committee decided to only use the progress reports as submitted by project leaders. The Dutch government interpreted its self-imposed role as 'not being an actor in the debate', as taking a wait-and-see approach. Staff from the relevant Ministries were present as observers in Committee meetings but did not interfere with the course the Committee took.

Section 5.5 In conclusion

In this chapter my aim was not merely to study interactions in local spaces for assembly but to trace the dynamics between the local spaces and the goals, set up and outcomes of the Dutch Societal Dialogue as a whole. In this final section I will discuss and reflect on the dynamics between the activities at the different levels, and their effects on the proceedings and outcomes of the Dutch Societal Dialogue. Although I have not analysed the interactions that occurred at the different levels

[95] This is a traditional way to evaluate mass media campaigns, which seems less appropriate for a dialogical communication process. However, it is one with which people have more experience, so recourse to it may easily occur.

[96] As the Chair stated in an interview for ObservatoryNANO (2011), 'society ought to define the menu, and do the cooking themselves' (Malsch, 2011).

in terms of public-sphere type interactions, because, as already noted, this would not be meaningful (e.g. Committee members did not represent developers or promoters of nanotechnology and civil society actors, and some local spaces for interaction were from the outset aimed at the realization of communication as transmission or the stimulation of interactions between citizens only), by studying the various activities, it is possible to say something about how deliberation, negotiation and aggregation were stimulated, and what effect this had.

The space for the Dutch Societal Dialogue on Nanotechnology resulted from the fact that the Dutch government provided resources with the aim of gaining input to create a widely accepted policy on nanotechnology, in particular with regard to ethical and societal issues that had not yet been taken up by other institutions. The actual organization of the Societal Dialogue and its evaluation was commissioned to an ad-hoc Committee, which decided to go for distributed activities by inviting and selectively funding a diverse range of project proposals to organize local spaces, such as science cafés, magazines, interactive websites and TV programmes. One of the features was that decisions with regard to the content and process of interaction were mostly left to project leaders. The participants that assembled in the local spaces were invited by these project leaders. As we have seen, most project leaders were oriented towards public awareness of nanotechnology, and risk and safety issues were central topics.

Was the eventual backgrounding of social and ethical issues the result of contingencies in the process of organizing the particular multilevel configuration, or did it have to do with general difficulties that occur when the aim is to discuss ethical and societal issues with a general public that has a low level of awareness of nanotechnology? And, subsequently, what would be requirements to do better? There were definitely contingencies in the way the Committee interpreted its mandate to organize the Societal Dialogue. The Interdepartmental Working Group carefully prepared the composition of the Committee so as to have some assurance that the thrust of the mandate would be followed. However, limitations in terms of who was available and willing to devote their time and effort, played a role, leading the Group to compromise. Subsequently, during the process, some Committee members turned out to have less time than had been foreseen (my observations). Moreover, as we have seen, the Chair was very much focused on management of the process and less oriented towards content. Another contingency was the decision of the government, via its observers on the Committee, to not interfere, even when deviations from the thrust of the mandate were noted. The independence of the Committee had priority.

What appears to be less contingent is the reduction of ethical and societal issues to risk and safety issues and the focus on disseminating knowledge from the world of nanotechnology to civil society. We have seen that the Committee initially put forward broader issues in their call for proposals, as articulated in interaction with stakeholders from industry, nanoscience, policy and CSOs. These broader issues, in the form of a so called 'priority list', contained societal issues related to the development of nanotechnology that, according to the stakeholders, were not sufficiently addressed by existing institutions. This priority list was offered to the project leaders as input to be considered when organizing the local spaces for interaction. However, in many projects, even at the proposal stage, and definitely in their execution, the focus was on understanding nanotechnology and on risk and safety issues. The Committee itself explicitly narrowed its focus as well. In developing their monitoring and evaluation criteria and writing their official reports, they moved away from the specific questions and issues they had originally put forward in their call for proposals to more generic questions about nanotechnology. What we see is that in developing their design and orchestration requirements, the Committee tried to stimulate public-sphere type interactions, but in selecting and monitoring the individual projects, its focus was not so much on stimulating inquiry and further articulation of the priority list, but on stimulating outreach and awareness raising.

This move partly explains why broader ethical and societal issues were backgrounded in the reports of the Committee: these issues are linked to functionalities and the embedding of particular applications, while risk issues are linked to nanotechnology itself (especially nanomaterials), which can be addressed and discussed independently of particular application domains. In other words, while specific projects could address broader ethical and societal issues (as they did), when project reports were aggregated in a Committee report, they would disappear. Similar effects can be found in relation to public engagement events concerned with nanotechnology in the UK and the US. Doubleday (2007) analysed four such exercises in the UK and two in the US, and noted the recurrent expectations that nanotechnology would deliver benefits and that society must manage unforeseen risks (Doubleday, 2007, p. 217). For the Nanojury exercise in the UK, Pidgeon and Rogers-Hayden (2007), who were present as observers, revealed the reduction of issues (in the recommendations) to the promises and risks of manufactured nanoparticles.

This tells us something about how our societies tend to address new and uncertain technologies: the technology is black-boxed twice. First, in the sense that the only thing that has to be done about it is to explain what it 'is' (the inverted commas are used because the technology is still evolving), and second, the technology is merely seen as a source of risks that have to be contained. These patterns

are part of an entrenched cultural repertoire in late-industrial Western societies which is used to manage new and emerging technology (Rip, Talma, 1998). Changes are possible (and sometimes visible), but as Swierstra & Rip (2007) and Joly & Kaufman (2008) argue, opening up or broadening existing ways of managing new technology is difficult in practice because there are almost no identifiable tools, routines or best practices on which actors can fall back.

Nevertheless, one can try to learn from attempts at broadening, even when they are not fully successful. For the Dutch Societal Dialogue, but also more generally, a key challenge is the low level of awareness about a new and uncertain technology, almost by definition. Part of the problem is already in the use of the term 'awareness', which construes the technology as something already out there, and that one (that is, the publics) can be more or less aware of. However, as argued throughout this thesis, emerging technology is highly uncertain and ambiguous as to what it might become (Stirling, 2007). Promises are voiced, but nobody yet knows what the new technology will become. This is a reason to move from awareness building to inquiry – in the sense of Dewey (1927) and Lindblom (1990). The notion of 'inquiry' is important because it encompasses all actors, not just the general public or lay citizens: nanotechnology is new and indeterminate for everyone, and no one has a complete overview of what is or might be at stake. Still, there is the question of sufficient information about and understanding of newly emerging technology: if absent, there is little basis for inquiry. The original two-phase approach of the Dutch Societal Dialogue actually considered this, although it separated awareness raising from inquiry, preceding it rather than make it part of the inquiry. This separation then allowed the Committee to postpone the inquiry phase altogether because they believed that much awareness raising (translated into outreach) still had to be done.

The combination of awareness raising and inquiry has been experimented with in specific domains of nanotechnology, for example in Constructive TA workshops where stakeholders explored possible new roles and responsibilities concretely (see for example (Robinson, 2010)). For a general societal dialogue, linked to general publics, this is much more difficult. One way to address this requirement is to have studies done which become input into the dialogue. The Dutch Societal Debate on Energy in the mid-1980s followed this approach, and the debates between experts and the recently informed were productive in their own right (the overall outcome was not taken up because the political stakes had changed over time during the exercise). With respect to risk and safety issues, it is usual that professionals carry out studies and bring their findings to the debate in terms of acceptable or unacceptable risks. In relation to broader ethical and societal issues, this move is not so

obvious, although there is definitely a role for professionals such as sociologists and philosophers of technology.

Thus, there is a quandary, not only in relation to the practicalities of organizing and orchestrating a societal dialogue where trade-offs have to be made, but also in terms of the balance between offering insights so as to enable inquiry (which will then be less open-ended) or offering no insights, with the real possibility that the inquiry becomes superficial (Lindblom, 1990). Again, the problem is exacerbated because of the broad character of the dialogue, covering nanotechnology rather than a specific domain. This could be taken as an argument against large-scale societal dialogues about newly emerging technologies. However, then the problem of policy choices that have to anticipate developments and issues returns, which does need some early public engagement. What is clear is not only that we can do better but also that 'we' (the different 'we's involved) have to reflect on what we want to accomplish through societal dialogue: to handle newly emerging technologies in our societies.

Occasion to extend the public sphere?

Finally, do the activities of the Societal Dialogue in themselves amount to an extension of the public sphere? Perhaps not. The Committee decided to stimulate activities in different local spaces – for example online, in science cafés, debate centres and in high schools – to discuss nanotechnology. Also, different publications (for example a popular science magazine, TV programmes and brochures) were produced to stimulate discussion. Thus, it can be said that between 2009 and 2011, building blocks for an extension of the public sphere were actively stimulated by the Committee and the project leaders. As shown above, most of the actual spaces for interaction that were organized did not offer much of an occasion for inquiry into and articulation of emerging societal issues, but were instead an occasion for civil society actors to improve awareness about nanotechnology. To extend the public sphere, relevant competences in inquiry and deliberation have to be developed, and affordances for local spaces have to be realized. The projects might have served as a starting point, but it is apparent that there has not been much follow up.

After the Dutch Societal Dialogue was officially concluded, many of the local spaces for interaction disappeared, or changed their topics. Websites have gone offline, science cafés and debating centres are definitely paying less attention to nanotechnology, and the religious group have not created

further debates or produced more brochures. However, the extension of the public sphere does not necessarily require more actual spaces, at least not in the short run. The point is that such spaces are seen as relevant and legitimate; in other words, there is an affordance. In organizing societal dialogues this seems to be the case. Today, it can be said that the Netherlands has a tradition in organizing societal dialogues as a (policy) response to concrete societal challenges (as it did with Energy, GM and Food, and the recent (2011) societal dialogue on scaling up livestock farms) or as a way to anticipate possible societal problems (in the case of newly emerging nanotechnology and the transition towards a biobased society).[97] In terms of competences, one can also think of extensions of the cultural repertoire. A recent study (Throne-Holst, 2012) offers an indication: in focus groups on nanotechnology with consumers in Norway, an overall storyline became visible: 'new is risky; yes, but old technology is risky too; new is risky but it also has new advantages'. We have no data to tell us whether this storyline was visible in the interactions in the various projects of the Dutch Societal Dialogue. But the fact that a Societal Dialogue was held might lead to discussions of people about nanotechnology that follow this storyline, applying it to particular cases of nanotechnology-enabled products.

[97] In 2011, another societal dialogue was organized, this time about the pros and cons of scaling up livestock farms (see www.dialoogmegastallen.nl). In 2012, the Ministry of Economic Affairs, Agriculture and Innovation also commissioned the Dutch Institute for Societal Innovation (Instituut Maatschappelijke Innovatie) to organize a societal dialogue on the transition towards a biobased society (www.iminet.org).

Chapter 6 CTA+ workshops designed as microcosms

Introduction

This chapter will study interactions that took place within three spaces that I designed and organized myself. The aim of these spaces was to stimulate public-sphere type interactions about an emerging indeterminate situation which I had articulated based on my study of nanotechnology developments. As in the CTA approach (see especially Parandian 2012), the spaces for interaction that I organized were designed as microcosms, where groups of actors from separate (but not independent) worlds could meet and, in interaction, inquire into real-world indeterminacies occasioned by the introduction of novel nanosciences and technologies. Whereas in the CTA approach the spotlight is primarily on how to create a better technology development, for example by bridging the gap between innovation and ELSA, the aim of the microcosms that I designed was to inquire into societal practices that are 'in the making' as a result of nanotechnology developments (that is, changing societal roles, values, relationships and responsibilities) and to stimulate reflection on how to value them.[98] To organize such microcosms, and to develop requirements for who should be involved and what kind of interaction and participation should be stimulated, I complemented the current CTA approach on emerging technologies with the requirements for the design and organization of good spaces that I developed in Chapter 2 (see Section 2.4). Therefore, I will speak of CTA+ workshops. This allows two types of analysis: whether and how CTA+ workshops designed as microcosms stimulated the occurrence of public-sphere type interactions, in particular 'inquiry' (Dewey) and 'action' (Arendt); and an evaluation of what the empirical findings imply for the design of CTA+ workshops as microcosms.

The concrete opportunity to organize CTA+ workshops was provided by the call for proposals by the Dutch Societal Dialogue on Nanotechnology (see Chapter 5) for projects aiming to stimulate a dialogue between civil society and groups of actors responsible for the development and embedding of nanotechnology. I developed a project proposal to design and organize CTA+ workshops on changing societal values, norms, roles and responsibilities in relation to the development of nano-

[98] See Te Kulve (2011) on institutional entrepreneurship and cooperation across the chain in the food packaging sector; see Parandian (2012) on strategies to break through waiting games in the domain of Organic Large Area Electronics.

enabled applications in healthcare which supported the novel practice of care-at-a-distance.[99] The project proposal was successful. Before presenting and discussing my findings, I will first sketch the broader context of CTA, and thus also of CTA+.

Bridging gaps between science and society

As already discussed in Chapter 1, in the world of nanotechnology, bridging the gap between the 'inside' world of nanoscience and technology, and the 'outside' world, occurs in various ways, for example by upstream public engagement, Codes of Conduct and ELSA studies within R&D consortia. These bridging activities are often initiated because of outside pressures on the nano-world, for example the requirement 'to act responsibly' (see EU Code of Conduct, 2008). As Rip & Robinson (2012) observe:

> *'What is new within the development of nanotechnology, compared to previous emerging technologies like nuclear energy or biotechnology, is that now anticipation of societal impacts is seen as being also a responsibility of nanotechnology developers.'*

Part of this recent development is how CTA activities, with their explicit emphasis on bridging separate worlds, have become accepted within the world of nanotechnology. While in 2004, when PhD students and postdocs of TA NanoNed, one of the flagships of the Dutch R&D consortium NanoNed, started CTA projects on nanotechnology, 'nano-scientists looked dubiously at the "intruders"', but at present, 'social scientists and other non-technical actors are welcome in the nanoworld' (Rip & Robinson, 2012).[100]

Technology developers and other stakeholders, such as government agencies, develop strategies to create better development procedures and ensure the embedding of science and technology, for example by providing information to civil society in an early stage of the development and/or inquiring into issues that are directly connected to the development of nanosciences and

[99] The reason why I chose to focus on nano-enabled applications in healthcare was that clinical pilots are being carried out in this domain. In this phase, the functionalities of an application become visible and actors articulate considerations and expectations about societal practices, new or adapted roles, responsibilities, values and norms.

[100] For example, the roles of the CTA scholars Robinson and Parandian are recognized and appreciated in the world of nanotechnology. The network of Excellence Frontiers considers Robinson a 'knowledgeable visitor' (Robinson, 2012). Parandian was invited, based on his knowledge of CTA, to become part of a consultancy in Organic Large Area Electronics, one of the domains he investigated in his PhD.

nanotechnologies, such as inquiry into indeterminacies concerning whether and how nanoparticles pose health and environmental problems for society. Issues related to what kind of society is in the making and how to value this receive less attention. This is not because no one is raising these types of issues.[101] It is linked to the way newly emerging science and technology are developed in our society, in a concentric approach to technology development and societal embedding (Chapter 1). Actors that have professional responsibilities and mandates to develop and embed newly emerging nanotechnology can relatively easily background the broader issues and/or do not have opportunities to further inquire into these issues because they do not belong to their primary responsibilities. By designing and organizing CTA+ workshops, I wanted to create spaces as an explicit occasion for all actors to freely explore and reflect on these types of issues.

Design requirements to realize the aim of CTA+

To develop the design and orchestration requirements for CTA+, I complemented traditional CTA activities with requirements I developed on the basis of Dewey's work on reflective inquiry and Arendt's work on action. The point of departure of their thought resembles the point of departure for CTA activities, namely uncertainty, unpredictability and ambiguity in our activities. Dewey and Arendt proposed dedicated forms of interaction and participation in order to elucidate what is at stake (see Chapter 2). For them, the primary aim of these spaces for interaction was not to develop strategies for better technology development and better societal embedding, but to explore and reflect on the question: What kind of society are we creating? What are the requirements to live a meaningful life? To phrase it in Dewey's terms: 'what is at stake [in a reflective inquiry] is what kind of person one is to become, what sort of self is in the making, what kind of world is in the making' (Dewey, 1957). Although these larger questions were not explicitly addressed in my CTA+ workshops, the aim of CTA+ to anticipate changing societal roles, values, relationships and responsibilities occasioned by the introduction of novelties is compatible with them and offers opportunities to take up such larger questions. In this section I will indicate which design and orchestration requirements I developed for CTA+ workshops.

[101] For example, in one of my interviews, a spokesperson for IMEC, a research institute that develops components for nano-enabled body-area-networks, raised the concern: 'we now are able to generate 24/7 physiological data while people are ambulant, but the question is, do we want to use these technologies? Do we want to have all this information?

Similar to a traditional CTA workshop, in a CTA+ workshop those who are involved, that is, those who are implicated in an indeterminate situation, should participate. Participants of CTA workshops are invited because something is at stake for them, even while the stakes might be different (Rip & Robinson, 2012). The five phases of Dewey's reflective inquiry (cf. Chapter 2) were used to develop a concrete format for the CTA+ workshop. The point of a reflective inquiry (for Dewey, for me) is that people prepare for a future situation, as in rehearsing a play. Whereas for Dewey it is the existential experience of indeterminacy (first phase) which leads to dramatic rehearsal,[102] for the purpose of a CTA+ workshop, a dramatic rehearsal is organized to anticipate indeterminate situations in the making. In Chapters 1 and 2, I argued that due to the way newly emerging science and technology are developed in our society, the development of an indeterminate situation regarding changing societal roles, responsibilities, values and norms occurs to a large extent behind the backs of actors and is not intentional. The CTA experience has shown that CTA analysts (social scientists or philosophers) can take the role of mediators and provide a first articulation of an indeterminate situation by moving in the different worlds, observing, asking questions and studying what is happening. Based on this, the CTA analyst develops a diagnosis of what is at stake, which becomes the starting point for sociotechnical scenarios. These are based on controlled speculation (Te Kulve, 2011) and will start with the actual dilemmas, concerns and activities of actors. A problematic situation gives rise to different responses, and these possible responses are the starting point for developing narratives that explore action-reaction patterns and the consequences of various possible actions. Such a scenario can be seen as a virtual reflective inquiry. When reading the scenario, those who are involved can see themselves embedded in a broader development, and the narrative demonstrates how possible actions, interactions and repercussions might play out and lead to particular societal practices in which some norms, values, roles and responsibilities can be more easily pursued than others. During the workshop, scenarios can function as a platform for actors to articulate problematic issues in interaction and develop and rehearse new or adapted norms, values, roles and responsibilities (Te Kulve, 2011). Participants can modify and add to the scenarios. Based on the diagnosis, the CTA analyst selects and invites those who are implicated. The subsequent three phases of a reflective inquiry: (i) the transformation of an indeterminate situation into a problematic situation by means of inquiry and articulation, (ii) the formulation of hypotheses about possible solutions to deal with problems, and (iii) the interactive rehearsal of how possible solutions might work out in practice, are taken up in three successive interaction rounds. The first two occur in the

[102] People are affected by the consequences of actions and are able (at least to a certain extent) to recognize this and articulate how they are hindered in their daily activities. According to Dewey, the experience of disruption forms the incentive for people to organize themselves and initiate a dramatic rehearsal because they have an urge to solve their problems in order to continue their daily practice.

CTA+ workshop, and the third through follow-up interviews one month after the workshop, in which the workshop organizer evaluates whether and how the last phase – the real-life testing of insights gained in reflective inquiry – occurred.

Participants in a CTA+ workshop are invited to perform the activity of 'action' (Arendt), by sharing their concerns, dilemmas and stakes so that others can respond. This also contributes to inquiry: by sharing activities and issues in a CTA+ workshop, and by hearing others, insight can be generated into what is happening in the different worlds and how the different activities might add up to particular patterns that influence how novelties will be materialized in society. 'Action' in the sense of Arendt may also occur because participants are invited to risk their identities during the workshop, that is, to accept that their own institutional roles, responsibilities, values and norms are partial, contingent and temporal; and to explore and develop, in interaction with others and in relation to the indeterminate situation, new or more adapted perspectives.

Analyses of earlier CTA workshops have shown that interactivity between different actors responsible for the development and embedding of newly emerging technology, and listening for the sake of understanding, do not come naturally (Parandian, 2012). Thus, to stimulate the activity of action, explicit moderation is needed. Even if there is a disparity between participants, for example with regard to knowledge, for the aim of identifying problematic issues, each participant is equal because each is implicated, although in different ways, in the indeterminate situation and has particular views, experiences and knowledge with regard to what is at stake. A moderator may stimulate interactivity by inviting participants to share their experiences and dilemmas and actively question each other, listen with the aim of understanding, develop new or adapted roles and responsibilities, and rehearse possible lines of action to deal with problematic issues.

Structure of the chapter

For each of the three workshops I will analyse in some detail what type of interactions occurred between participants in relation to each other and in relation to the indeterminate situation. I will also pay attention to the effects of these local spaces in the real world, especially whether or not participants applied their learning in their daily practices.

I organized two workshops around the introduction of lab-on-a-chip devices in healthcare and a third workshop on the introduction of body-area-networks (BAN) in healthcare. Nanotechnology, as an enabling technology, contributes to the realization of a future vision that circulates in the healthcare domain: the creation of care-at-a-distance. The promise of care-at-a-distance, often voiced by policymakers and managers of healthcare institutions, is the provision of a new way to deal with the problem of an increasing number of ageing and chronically sick people who are in need of care on the one hand, and the chronic problem of understaffing of hospitals on the other.

Devices are being developed in the fields of lab-on-a-chip technology and body-area-networks, such as point-of-care devices and wireless sensor networks that can be used by patients to monitor their physiological condition or diagnose themselves while they are at home. With the realization of care-at-a-distance, the existing roles and responsibilities of patients and caregivers and notions of 'good care' will change. Because the development of these devices is still in an early stage there is uncertainty and unpredictability about whether and how promises will be taken up and how healthcare practices will change. What is apparent at this moment is that those who are involved, technology developers, patients, caregivers, insurance companies, patient organizations and policymakers, have different expectations of these new medical devices and have different perspectives on what is at stake.

The actual implementation of the design requirements varied between the workshops. Workshop 1 was centred around a concrete device, the lithium chip, and included intended users in the workshop. Workshop 2 was not centred around a concrete application but an emerging new societal practice, the use of all kinds of self-tests.

During the organization of Workshop 2, I realized that the emerging practice of self-testing did not entirely meet the requirements as set out in Chapter 2, but I decided to continue with the workshop, partly because I had to generate output for the Dutch Societal Dialogue. At the same time, however, it turned out that the timeframe I proposed in my project proposal was too optimistic. My original goal was to prepare and organize four CTA+ workshops within a period of 32 weeks (which was the formal period for the first round of projects during the Societal Dialogue). As Parandian (2012) and Robinson (2010) stipulated, one has to consider a period of 14 weeks to prepare and organize a CTA workshop. On this basis, the organization of four workshops would have required 56 weeks. Moreover, to meet the wish of the Committee to increase the outreach of my project, I proposed the organization of two public meetings alongside the CTA workshops (within the same timeframe of 32

weeks). Eventually, with the permission of the Secretariat of the Dutch Societal Dialogue, I dropped one workshop. What can be learned from this experience is that one should, ideally, have enough time to switch topics as soon as it becomes apparent that there is no recognizable indeterminacy.

Workshop 3 was centred around a concrete application, the wireless ECG patch, but unlike Workshop 1, no direct users of this device participated. Details of the set up of each workshop are provided in the relevant sections. In the final section I will evaluate what can be learned from the three CTA+ workshops with regard to the question of good spaces that allow for public-sphere type interactions and also discuss possible wider implications.

Data collection and methodology

To identify and articulate the indeterminate situation, I had to become familiar with the dynamics and actual dilemmas and issues of nanotechnology developments in healthcare. In addition to desk research (analysing papers and reports with regard to nanotechnology developments as well as healthcare dynamics), I also moved around in the worlds of nanotechnology and healthcare. One example is my participation in a 'Health and Technology' conference in 2010. At this conference, I approached people from IMEC, and they introduced me to the work on the ECG patch, which became the theme of my third workshop. I also participated in a conference called 'Handen en Hoofd aan het Bed', which focused on current challenges in healthcare. I also conducted interviews with different types of actors, such as scientists, industrialists, innovation consultants, patient organizations and caregivers, in order to increase my understanding of this domain and to map their activities, expectations and dilemmas. In interaction with my supervisors and colleagues from the University of Twente, I then developed a sociotechnical scenario for each workshop. To stimulate interactivity and to encourage participants to use insights from the workshop in their daily practice, the scenarios had to be written in such a way that the various actors could recognize their positions and the issues. Thus, connecting the narrative to the actual practices of actors was important, including various statements made by them.

The conversations during each workshop were recorded and transcribed.[103] To analyse whether and how the activity of action occurred, I could build on my interviews with each participant prior to the workshop. Thus, I had insight into how each participant articulated his or her role and responsibility in relation to novel developments of nano-enabled applications for care-at-a-distance. Listening to what they were saying and observing interactions (there was also an independent observer in each of the workshops), as well as cross-checking using the transcripts, I examined whether and how participants brought these roles and responsibilities up for deliberation and negotiation during the workshops, and whether they explored new ones after hearing about the concerns, values and activities of other participants.[104]

About one month after each workshop, I conducted follow-up interviews with participants to find out whether and what they had learned from the CTA+ workshop and whether and how insights were taken up in actual practices. In my evaluation, I distinguished between three forms of learning (cf. Parandian, 2012; Van Merkerk, 2007). First, I evaluated whether learning occurred in the sense of a better understanding of the technological device and its promises. Did participants gain more insight into how the application works and for which problems it proposes a solution? Second, I evaluated whether participants gained a better understanding of new societal practices that are unfolding in relation to new science and technology developments. Do participants reflect on their own positions, responsibilities and mandates in relation to the new societal practices? And third, I evaluated whether participants gained a better understanding of assessment frames, and the responsibilities and mandates of other groups of actors that are involved. The questions I asked during the follow-up interviews can be found in Appendix 2 to this chapter.

[103] I note that interactions during the workshop were conducted under the Chatham House Rule. This rule implies that participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any participant, may be revealed http://www.chathamhouse.org/about-us/chathamhouserule.

[104] For Workshop 1, as well as for Workshop 2, an explicit intervention with a white board and yellow notes was created to stimulate interaction during the second round (that is, the formulation of possible strategies for how to deal with problematic issues as these were articulated in the first round). See Appendix 1 to this chapter for a detailed description of the intervention and underlying assumptions. After Workshops 1 and 2, the moderator and I concluded that the intervention did not contribute much to the discussion in the second round. It served as a way for the moderator to summarize the discussion and to suggest ways forward, but overall the intervention led to confusion on the part of the participants. They repeatedly asked: 'What do you expect?' For the organization of Workshop 3, we chose to stimulate discussion through moderation only.

Section 6.1 Workshop 1 - The lithium chip

Real-world dynamics

Lab-on-a-chip technology can be applied for different purposes. One possibility is to create diagnostic sensors, in particular to measure lithium levels in blood. This led to the creation of a start-up company, which is now developing and testing such a device: the lithium chip. The idea is to create a point-of-care test (POCT) for people who suffer from bipolar disorder and use lithium as a medication to treat it. POCT refers to medical testing that does not require samples to be sent to a laboratory. The point of care can be a patient's home, the bedside of a patient or a professional setting. POCT provides immediate results. Currently, patients with bipolar disorder who use lithium as a medication have to go to hospital four or five times a year to check their lithium levels. The developers of the lithium chip see a future in which people can check their lithium levels 'anytime, anywhere', without the need of a laboratory (www.medimate.com).

> *'With just one drop of blood, the lithium chip will immediately display whether the lithium level of a patient is still within the permissible range. Patients can act upon these results if they think it is necessary.'*

According to the developers of the lithium chip, the quality of life of users will improve because they will become less dependent on professional healthcare and be more in control with regard to their own bodies. The lithium chip is still in the phase of clinical testing but it is expected that it will come into use in the near future. However, as became clear in my interviews, psychiatrists, patients, insurance companies, patient organizations and the technology developers all had different ideas about how to introduce and use the chip and had different perspectives on what is at stake.

Existing roles, responsibilities and notions of good care will shift but it is not yet clear in what way. The interviews that I conducted prior to the workshop revealed that both psychiatrists and patient organizations are calling for the use of the chip in professional settings, while some patients express their desire to use the lithium chip at home. The developers are interested in creating revenue and are exploring both of these options. If the lithium chip were to be used as a home care medical device, the responsibilities and roles of the patients would change. The patient would have to perform specific actions and decide whether or not to act upon the results. The role and

responsibilities of psychiatrists would also change. Currently, the laboratory sends the results of lithium checks to the psychiatrist. In interviews, psychiatrists emphasized that one of their responsibilities is to remain in control, meaning at least being aware of the actions patients are taking in relation to their medication. Some patients said that they were looking forward to using the lithium chip at home because it would reduce the need to travel and by having their own chip they can experiment with their medication to find the optimum level. Other patients, however, were reluctant to use the chip and feared that they may not interpret the results correctly. These patients were also concerned that the chip would replace face-to-face contact with the psychiatrist. The patient organization only saw possibilities for the use of the lithium chip in a professional setting, considering most patients to be incapable of interpreting the results correctly.

The insurance company articulated difficulties with regard to reimbursement. Currently, only care provided in certified institutions, such as hospitals is reimbursed. Furthermore, the insurance company doubted whether it would reimburse all home care measurements or only those prescribed by a medical professional.

Sociotechnical scenario and selection of participants

With my supervisor and colleagues from the University of Twente, I developed a sociotechnical scenario[105] of what might happen in the near future (timeline from 2011-2015),[106] with regard to the changing roles, responsibilities and mandates of groups of actors involved (See Text box 1). Prior to the workshop, the scenario and a short description of the set up of the workshop were sent to the participants. Based on my diagnosis of current dynamics around the development and embedding of the lithium chip, I had selected and invited various actors. These were lithium-chip developers, insurance companies, patients, patient organizations, psychiatrists, scientists working on lab-on-a-chip technology and medical laboratory technicians. Representatives from all of these groups were present at the actual workshop, except for medical laboratory technicians. Also present was an innovation consultant who lobbied insurance companies to invest in the development of the lithium chip. I did not personally come across the innovation consultant while preparing my diagnosis, but he was pointed out to me as of possible interest in one of the interviews. The insurance company

[105] I developed this scenario with the assistance of Marianne Boenink, Federica Lucivero and Arie Rip.
[106] The three workshops took place in 2010. At that time, 2011 and 2012 were still in the future. The lines of action sketched in the narratives are controlled speculation and do not necessarily match actual developments that subsequently took place in 2011 and 2012.

present at the workshop was involved because it supported the further development of the lithium chip, but like any insurance company it also had to make decisions about reimbursement.

Text box 1: Summary of the narrative in the sociotechnical future scenario. The narrative focuses on changing roles, responsibilities and values of 'good care' in relation to the development and embedding of the lithium chip

In 2011 an alliance between an insurance company, psychiatrists and a patient organization for people with bipolar disorder advises that the lithium chip only be used in a clinical setting so that psychiatrists can maintain control. This advice was developed on the basis of results of a pilot study conducted by the Dutch national centre of expertise on mental health and addiction. Following this advice, the Ministry of Welfare, Health and Sport starts to develop guidelines for the embedding of the lithium chip in clinical settings. A group of patients that participated in the pilot study does not feel represented. For them, the lithium chip can contribute to their quality of life (more freedom, less dependency) and they demand to have their own lithium chip at home. They set up a foundation called 'Heft in Eigen Hand' and approach foreign lab-on-a-chip developers with the request to develop a lithium chip. In 2012, a company in the Czech Republic, licensed by Medimate, is willing to develop the chip and sell it on the internet. Psychiatrists are watching these developments with great concern. From their perspective, patients using the chip at home undermine the authority and knowledge of psychiatrists. Some psychiatrists threaten not to treat these patients any longer because the responsibility and accountability issues for home care use are not defined properly. In 2013, a case of severe toxicity occurs caused by home care use of the lithium chip. Who is responsible, the patient or the psychiatrist? The medical disciplinary tribunal judges that the psychiatrist is not to blame. When point-of-care devices are used at home, patients are responsible. In the course of 2014, the verdict leads to societal upheaval. Politicians publicly question the benefits of free market dynamics in healthcare and the increasing demand on individuals to be proactive about their own mental and physical health. In 2015, the Ministry of Welfare, Health and Sport wishes to restore the authority of medical professionals, with the professional and not the patient having the final responsibility for home care testing. However, the Ministry is too late; the medical disciplinary tribunal has already judged otherwise.

Preparing and rehearsing futures: interaction dynamics in the workshop

Participants explored and reflected upon the narrative sketched in the scenario quite extensively. Issues that were most discussed were: 1) Should the lithium chip be used at home or in a clinical setting? 2) Who should interpret the results of the measurements? Participants agreed that for this kind of patients, the use of point-of-care devices cannot be assessed following the same criteria that have been set in the past for other point-of-care devices such as those that measure blood sugar levels or blood pressure.[107] 3) How should the lithium chip be reimbursed?

In general, there was quite a lot of interactivity in the workshop. All of the participants shared their views, values and concerns, and, apart from the professor of lab-on-a-chip technology, all participants questioned other's roles and responsibilities, albeit some more so than others. Below, the psychiatrist (P) and the innovation consultant (I) question the role of Medimate (MM) with regard to the issue of whether and how the lithium chip should be introduced onto the free market:

01:13:44-6

P: But you do have more interest than just selling as much of your product as possible, or don't you?

01:13:53-1

MM: I guess that a product ... it remains a difficult story. You do want to develop your market further, but our ambition is not to sell our products in local pharmacies. We definitely perceive ourselves as a producer operating at the interface between patients and caregivers, leaving aside for a moment the exact type of relationship between patient and caregiver. This implies that we have to collaborate closely with the caregiver, but also with the financers, like the insurance companies. So in the long run it is of no use to strive for market volume, but you should want to offer a solution, that is what we aspire to, offering a solution. The way we approach the market, by working closely with psychiatrists, the insurance companies and the patient organization, shows that we are aware that we are just one

[107] Blood sugar measurement devices (for people with diabetes) and blood pressure monitors can be bought in pharmacies and on the internet without the involvement of a physician. Consequently, patients can use these devices anytime, anywhere. According to the participants in the workshop, the use of these devices and the interpretation of the measurements are quite clear cut. For example, a patient with diabetes measures his or her blood sugar level a few times a day and can inject him/herself with insulin (the adequate dose of insulin is determined with the physician). Participants in the workshop stated that using a lithium chip to deal with bipolar disorder is a more complex situation. First of all, there is a risk of severe toxicity, and second, the interpretation of a particular result is not straightforward but should always be seen in relation to the mental health of a patient.

part of the politics. The lithium chip will not solve the problem. The chip will not change the symptoms, and will not change the use of medication. It is a tool in the overall process.

01:14:56-4

I: But the lithium chip will be introduced to the market in five years' time. And thousands of them will be sold. And then will you say, 'No, we only sell to care providers?' Or will you say, 'Okay, we'll sell them too'?

However, contributions to the discussion tended to emphasize the participants' own perspectives and roles: they presented their stakes and concerns as input into the discussion, but did not articulate how the activities, values and concerns of others related (or not) to their own roles and responsibilities, and/or their stakes and issues were not questioned by other participants. In the interaction sequence below, for example, in response to the issue of whether or not people with bipolar disorders are vulnerable, one of the patients (RAM) expresses the value she attaches to having interactions with a psychiatrist. The lithium-chip developer (MM) responds, not by questioning this experience of the patient, but by expressing her own concerns and perspective. When she is finished, other participants respond, but not by questioning the stakes and issues expressed by the patient and lithium-chip developer.

00:54:43-8

RAM: Can I share a personal experience? I do not use any medication at all, and my SPV [psychiatric nurse] concluded that I therefore could/should not see a psychiatrist. While I think the opposite: because I do not use medication, I have the right to reflect at a different level than with my SPV, and there's already a lot in that (…)

00:55:17-5

MM: But I also know psychiatrists, institutions where the management has the power, and decides for the psychiatrist which patient he or she has to treat. This has nothing to do anymore with what the psychiatrist wants. We are now talking about a model in which patients and psychiatrists have a great relationship and are in a position to choose. The patient can choose to switch psychiatrists. What I hear from patients is that they cannot get in contact with a good psychiatrist, there are waiting lists, and they are not happy with the situation, so the patients are constantly searching, and I talk to psychiatrists who say: I have to treat 200 patients with bipolar disorder in just a few hours, that is not doable, so it ends up with the SPV and he or she decides who counts as severe enough to see a

psychiatrist. So there is no relationship anymore between patients and … a confidential relationship I mean.

00:56:07-7

VMD: Well, there is some lopsidedness ...

00:56:13-9

P: But still, for me the question is: 'How can the lithium chip change this situation?

00:56:15-3

MM: It can't.

00:56:16-5

VMD: Then we don't have to discuss it, or maybe we do.

Sometimes the moderator stimulated the participants to question each other, which led some to develop ways to address problematic issues and to imagine, in interaction with each other, the possible consequences (i.e. new roles, responsibilities, norms and values) of following particular lines of action. For example, the lithium-chip developer Medimate, the insurance company, the patient organization and the psychiatrist together developed a possible scenario for how the lithium chip could be used at home. They articulated that for them good care implied that patients should be educated in how to use the chip and the psychiatrist-at-a-distance should know about the results of each measurement. The possibility of adding a telecommunication feature on the chip was explored, for example Bluetooth, in order for psychiatrists to remain informed. A problematic issue that the insurance company identified was whether or not insurance companies should also be notified about the results of measurements. The representative of the insurance company said that having such data would be one way to create personalized insurance packages, but he also wondered whether this would be desirable.

During the workshop, there was quite a bit of negotiation between the participants about what was at stake and what should be done, in particular with regard to how to regulate reimbursement of the use of the lithium chip. Below, for example, the lithium-chip developer (MM), the insurance company (AZ), the patients (RAM and ED) and the psychiatrist (P) negotiate about the meaning of self-management in relation to reimbursement.

02:18:28-5

MM: (...) what you can also say is, well, you reimburse the device, and you get ten chips a year, but if you want more, you have to buy them yourself. So Medimate, make sure you deliver directly to the patient, or that it is available, via the pharmacy or elsewhere ...

02:18:46-9

Moderator: Then is that also a form of self-management?

02:18:55-2

P: It has nothing to do with self-management.

02:19:04-8

P: Not in the way we discussed it before.

02:19:05-2

AZ: That is not self-management.

02:19:05-5

P: No, and not a case of personal responsibility either.

02:19:08-3

RAM: A choice.

02:19:11-9

AZ: A free choice perhaps. But you are always responsible for your own health, right?

02:19:17-2

P: But you are not making people more responsible with this.

02:19:25-4

Organizer: What does self-management imply according to you?

02:19:27-7

P: What does self-management imply? With regard to bipolar disorder, or?

02:19:32-8

Moderator: Let's start with bipolar disorder.

02:19:36-1

P: Well, keeping your life chart up to date,[108] *paying attention to day-night rhythms, paying attention to things that might disturb your sleep. If you are planning a holiday to the other side of the world, preparing carefully.*

02:19:47-6

ED: Not too many stimuli.

02:19:49-2

P: Well, say prepare and discuss things, etc. I think that has much more to do with self-management than using a lithium chip. However meaningful a lithium chip might sound. But for certain specific situations, like …

02:20:06-1

MM: But, then, in my opinion, in the way it is handled in the healthcare system, then we are talking about a situation in which you allow a patient to take responsibility without consulting their physician. What you propose is …

02:20:19-7

P: A patient can do that anyway, that is totally up to them, he can measure his lithium levels as many times as he wants. What do I care. But what I want to accomplish, the thing I will be held responsible for and will be accountable for when things go wrong, that is something I want to decide myself. If anyone wishes to use the chip on their own, it is up to them, I don't care.

The psychiatrist risked his identity (in Arendt's sense) during the workshop. Prior to the workshop he was sceptical about the added value of the lithium chip in home settings. The only added value he saw was the use of the lithium chip to provide on the spot measurements in clinical settings. However, after hearing details about the functionalities of the lithium chip and by actively listening to

[108] A life chart is a systematic collection of past and current data on the course of illness and treatment recorded by the patient and/or clinician. Earlier in the workshop, the psychiatrist and the two patients stated that if patients used the lithium chip at home, the results of each measurement could be linked to their individual life chart, and/or a psychiatrist-at-a-distance could be informed via Bluetooth.

the experiences and desires of a patient (ED), he started to reflect on his role and responsibility as a psychiatrist. Together, the patient and the psychiatrist explored their possible new roles and responsibilities in dealing with an emerging situation in which patients will use the lithium chip at home in the future. The patient (ED) articulated his desire to use the lithium chip at home because he wanted to experiment with his dosage in order to find the optimum level. The psychiatrist responded by questioning the added value of experimenting at home rather than in a clinical setting. The patient answered that, for him, the main driver is to become less dependent on the psychiatrist. He (ED) continued, in more general terms:

00:52:19-9

ED: Imagine if you don't have a good relationship with your psychiatrist, then …

00:52:20-3

I: Then you should find another psychiatrist?

00:52:26-2

ED: Finding another psychiatrist in Friesland is not that easy.

00:52:33-4

P: Yes, that is a problem.

The interaction sequence below shows how the psychiatrist, after first inviting the patient to articulate his opinion further, starts to imagine how he can adapt his current role and responsibilities to deal with new circumstances and challenges:

00:58:16-2

P: Can you tell us more about how you perceive the relationship between the client, the psychiatrist and the new device? How will the device change the relationship between the client and the psychiatrist?

00:59:05-6

> *ED: Well, you can perform your own measurements on a more frequent basis. You already have a life chart with results. I mean, with more frequent measurements psychiatrists might be able to give a more detailed and better diagnosis.*

01:00:00-8

> *P: Well, you are saying interesting things, because I also have patients with whom I agreed that they can experiment with their medication, in some situations. These patients might profit from using a lithium chip at home, in particular cases, for example when they are at risk. So, not for all patients, but for a few patients the lithium chip might be …*

Later on in the workshop the psychiatrist articulated his role and responsibilities in relation to the new situation in more detail:

02:20:29-7

> *P: It is of course a free market and clearly I cannot prevent patients buying a lithium chip, but as a psychiatrist I should have control and therefore I need to have face-to-face contact with my patients (…) However, when somebody wants to be treated by me in Groningen but is living in Beetgum, which is quite far away, then the lithium chip might be a solution in establishing a relationship with that person, because he cannot come to Groningen every time.*

The way the patient and psychiatrist interacted corresponds to Arendt's notion of action: responsibilities, values and norms emerged through inquiry into present challenges and by daring to put existing routines moral values at risk in order to explore new ones. This kind of interaction, to prepare for a possible future situation, only occurred once during this workshop.

Effects of the workshop in the real world

One finding in the follow-up interviews was that for all participants the scenario stimulated learning and reflection on future societal practices that are in the making. Medimate and one of the patients indicated that the actual interactions in the workshop did not contribute much to increasing their understanding of what was at stake. This may be related to the fact that, together with the chair of

the patient organization and the insurance company, they were both already aware of each other's positions and perspectives, being members of the advisory board set up by the developer of the lithium chip. Inspired by a CTA workshop organized in 2006 by Van Merkerk (2007), the developer of the lithium chip decided to start an advisory board with potential users and an insurance company to discuss the development and embedding of the lithium chip. Referring to this advisory board, Medimate stated:

> *'The workshop interactions did not really offer new insights. But I thought, well, the scenario absolutely opened my eyes. For example, the way you described how foreign companies, licensed by us, could sell the chip on the internet (…) that is something. I distributed the scenario to my colleagues and told them to be aware, this is what happening and we should prepare ourselves.'*

Other participants also indicated that they took up insights from the workshop in their daily practices. The psychiatrist discussed insights from the workshop with his colleagues. The professor of lab-on-a-chip technology initiated real action. In 2010, she was co-organizer of a large international conference on lab-on-a-chip-technology. She invited me and the moderator to organize a round table discussion about the ethical and societal aspects of lab-on-a-chip technology because she anticipated that her colleagues would be interested in hearing about this. Although the professor had not been active during the workshop, she mentioned that she did learn quite a bit from it:

> *'The workshop was really fruitful for me. I have worked on lab-on-a-chip technology for more than twenty years now. But, to be honest, I never thought about the fact that people are actually going to work with lab-on-a-chip and that it can change healthcare practices'*

This position of the professor is illustrative of the traditional position of scientists operating solely in the laboratory and not taking broader issues into account. However, it is not a message of despair. The CTA+ workshop made a difference, making her enthusiastic and reflexive about her current role and responsibilities. For example, she referred to how some participants thought there were too many promises attached to the lithium chip (and to lab-on-a-chip in general). She related this to her own tasks and responsibilities as a scientist:

> *'Because of the workshop, I started thinking about our role as scientists. I think we have to leave our lab on a more regular basis to communicate and inform people about the possibilities. I think the expectations about lab-on-a-chip are too high at the moment. We probably also need to interact with end-users at an earlier stage and thus possibly develop a different technology'.*

In summary

The aim of CTA+ workshops was to stimulate public-sphere type interactions in the form of reflective inquiry and action. The Table below summarizes the specific features of these types of interactions and indicates which actually occurred. These will be discussed below and also in the final section of this chapter.

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.	
	Public-sphere type interactions	**Workshop 1 Lithium chip**
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.	++
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.	++ + ++
Articulation	Articulation of emerging common, (public) issues	+
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks	+
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)	++
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation	+
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes	+

Indeterminacy with regard to the further development and embedding of the lithium chip was recognized by the participants, and all the participants of the workshop positioned themselves explicitly as involved in the indeterminate situation. Some of the participants already knew each other from the advisory board of Medimate, but during the follow-up interviews these participants stated that anticipating changing roles, values and responsibilities was new to them.

During the workshop, I primarily had the function of observer, but also probed into the discussion to some extent, based on the knowledge I gathered while moving in and around the world of nanotechnology and healthcare.

During the follow-up interviews, it appeared that some participants had discussed insights from the workshop with colleagues (Medimate had even distributed the scenario). There was no further dispersion of insights because of the Chatham House Rules.[109]

Section 6.2 Workshop 2 - Self-testing

This workshop was not centred around a specific nano-device, but around a general practice, that of medical self-testing in home settings.

Real-world dynamics

Recent developments in lab-on-a-chip technology, in-vitro diagnostics and an increasing knowledge of biomarkers have stimulated the development of point-of-care devices for self-testing for numerous diseases, such as cancer, diabetes, HIV and hepatitis, which can be bought by consumers on the free market. The notion of point-of-*care* presumes a situation of care; however, such a situation is precisely absent in the case of self-testing: without the intervention of a medical expert, a person can make a diagnosis about his or her physical condition based on the test results (Janssens & Van Pelt, 2011).

[109] As a project leader, I aggregated interaction dynamics and issues from the three workshops into a report for the Committee of the Dutch Societal Dialogue. This report was not publicly accessible, therefore issues from the workshop did not immediately become visible outside the protected space of the microcosm.

Below, I provide an overview of the invitation text that was sent to the participants. It describes sociotechnical dynamics around self-testing, in particular 'high-risk tests' ('*hoog risico testen'*), as these were visible in 2010. Self-testing fits within a broader political-economic dynamic that is visible in our society. The slogan 'prevention rather than cure' is becoming dominant and strategies are being developed by policymakers and insurance companies, as well as others, to stimulate people to become more responsible for the course of their own health, for example by offering cheaper insurance when people quit smoking or start exercising. The emphasis on prevention and the increasing number of self-tests on the commercial market provokes different responses from different stakeholders. According to the Dutch College of General Practitioners, preventive testing for cancer might lead to unnecessary concern and needless medical check-ups (Nederlands Huisartsen Genootschap [NHG], 2008). The Council for Public Health and Healthcare in the Netherlands (RVZ) advocates allowing the consumer to decide whether or not to use self-tests (Raad voor Volksgezondheid & Zorg). Against this notion, the Ministry of Health, Welfare and Sport decided to mark self-tests for cancer, HIV and hepatitis as so-called 'high-risks tests', for which a special law applies, to the effect that these tests can only be bought by consumers with the involvement of a medical expert or pharmacist who is able to provide adequate information to the consumer. This law was introduced by the Dutch government because it considered that the test results could have a major impact on a person's wellbeing and medical guidance is required in such cases. In 2008, the Healthcare Inspectorate published a position paper in which it proposed abandoning this law because it was nation-specific and Dutch citizens could buy the tests on the internet anyway (Inspectie voor de Gezondheidszorg, 2008). At the European level, there are debates about the proper regulation of POCT devices. Currently, POCT devices can be introduced on the commercial market as long as manufacturers comply with the essential requirements (CE-marking) to produce safe devices that contain adequate constructions for use. However, the Healthcare Inspectorate and the Ministry of Health, Welfare and Sport have both called for a revision of the current regulation to also take into account the potential users of POCT devices and develop guidelines to assist in determining which cases require medical guidance. How should we deal with this emerging situation and the different stakes that are involved? The CTA+ workshop was set up to provide an opportunity for those who are involved to inquire into these dynamics around the practice of self-testing and articulate what is at stake with regard to changing roles, responsibilities and values, and what should be done.

Sociotechnical scenario and selection of participants

Based on the situation mentioned above, I selected and invited spokespersons from the different areas involved. These were of course spokespersons for the different institutions mentioned above (such as policymakers from the Ministry of Health, Welfare and Sport, the Healthcare Inspectorate, general practitioners), but also patient organizations, because of their business model to represent the values, needs and concerns of patients, and developers of point-of-care-devices. Unfortunately, no representative of a patient organization was able to attend the workshop. A policymaker from the Ministry of Health, Welfare and Sport (VWS) and a general practitioner also expressed their interest in participating in the workshop but had to cancel at the last minute due to prior engagements. A spokesperson for NEN, the Dutch Normalization Institute (NEN), also approached me with a request to join the workshop. She had heard about it from a colleague at the Healthcare Inspectorate and thought that it was a good opportunity to gain more insight into this field because, as she stated, there is a lot of confusion in the field about what is happening and what the criteria for self-tests are. The aim of NEN, as she articulated, is to bring stakeholders together and jointly develop binding agreements. As it turned out, she got stuck in traffic and was not able to make it in time. Present at the workshop were a developer of self-tests, a spokesperson for the Healthcare Inspectorate, two innovation consultants working in the field of point-of-care testing, a person working for the Dutch National Institute for Public Health and the Environment (RIVM), and a professor in clinical and forensic toxicology who is also employed as a pharmacist. He dealt with people concerned about the results of self-tests daily.

Within the domain of self-testing and point-of-care testing there is confusion about terminology. Clinical laborants refer to POCT when speaking about self-tests used by people in home settings as well as POCT devices used in professional healthcare settings (Jansen& Van Pelt, 2011, p. 16-17). The Healthcare Inspectorate in contrast differentiates between self-tests for consumers and POCT devices used in professional settings (Inspectie voor Gezondheidszorg, 2008). To develop the scenario, I used the terminology of medical point-of-care testing, which refers to testing at any point without the involvement of a physical laboratory. This ‘point’ can be the patient’s home or the bedside of patients in professional healthcare settings.

Text box 2: Summary of the narrative in the sociotechnical future scenario. The narrative focuses on emerging societal practices occasioned by the availability of self-tests and changing roles and responsibilities of individual citizens and others.

2015

In 2015, point-of-care devices for numerous diseases are available on the consumer market. People can buy these devices without the interference of a medical expert and test results are immediately displayed. The Dutch government decided to abandon the law that canalized the sale of so called 'high-risk' self-tests, that is self-tests for cancer, HIV and hepatitis, because Dutch citizens could buy the tests on the internet, so the nation-specific law could no longer be maintained. It appears that many citizens are eager to buy self-tests. Users claim that the quality of their life is improved because they experience more control: 'knowing that your health is okay encourages the making of important decisions, such as pursuing a new job'. Insurance companies increasingly stimulate their customers to use the self-tests available. Those who do, pay lower premiums. In healthcare institutions, the traditional task of laboratories to analyse and interpret test results has been taken over by a certified group of nurses. These nurses can interpret the immediate results of point-of-care devices at the bedside of patients and can decide, in interaction with medical specialists, on the appropriate treatment for the patient. Policymakers, insurance companies and managers of healthcare institutions are thrilled about these new developments because of the cost reduction due to no longer having to finance expensive laboratories.

In 2016 and 2017, societal dilemmas become apparent. There is increasing pressure to use self-tests preventatively. People who are afraid of the outcomes and decide not to use these tests feel guilty, and relatives confront them with their shortcomings. General practitioners complain about an increase in overanxious patients who are convinced that they have a serious disease after using self-tests. These patients demand the time and effort of the general practitioners, though most of the time nothing is wrong. In protest against this new culture of preventative testing, a civil society organization has been set up. On their website it can be read: 'we choose happiness and freedom, not fear. A human body is not a potential danger but a gift that enables people to enjoy the here and now. We do not want to be slaves to more knowledge; therefore, we do not want to use self-tests'. In 2017, the media focuses on a story of a mother and daughter who both died from a genetic form of breast cancer. Medical specialists and patient organizations blame the mother for negligence and for causing her daughter's death. In 2015, the mother discovered a lump but was too

afraid to inform her relatives and go to the hospital because earlier that year she ignored an invitation from her insurance company for a preventative checkup. As a result, she feared that her relatives and the medical specialists would blame her for being irresponsible and so she decided to keep her mouth shut. In response to this story, politicians, insurance companies and healthcare professionals started deliberating and negotiating about how to deal with such apparently irresponsible and negligent citizens.

Preparing and rehearsing futures: interaction dynamics in the workshop

The existing confusion about terminology was immediately brought up for discussion by the representative of the Healthcare Inspectorate. In his opinion, the scenario was not precise enough with regard to the terminology. There was a discussion between the participants about what should be the focus of the workshop and it was decided that self-testing for individual citizens was the most 'exciting topic'. The healthcare inspector (IG) explained:

00:36:25-2

> *IG: And if we focus on that and leave the point-of-care issue, and the professionals that are involved, I think we will have a very exciting discussion. And then we of course will also get to the point of whether people can decide about their own future or not, and that's an interesting debate.*

With exception of one of the medical innovation consultants, all the participants were quite active during the workshop, in the sense that they all shared dilemmas, stakes and concerns with regard to self-testing. This issue of the self-determination of citizens to use self-testing became one of the main topics for deliberation, and participants coupled it to the issue of increasing societal pressure as mentioned in the scenario. Societal dilemmas were articulated, such as an increase in the 'worried well' and the pressure this group might put on the capacity of the healthcare system, resulting in a situation in which there is less time to treat people who really are ill. What was striking compared to Workshop 1, and also Workshop 3, was that participants articulated societal issues that were not expressed in the scenario. For example, participants connected self-testing to lifestyle and discussed the possibility that people who live a healthy life, for example by not smoking, might use self-tests regularly as a way to stay healthy. The issue of societal pressure was discussed in relation to the question of whether and which organizations should have the right to demand preventive testing. Participants were in agreement that self-testing done by people in a home setting had a lot of

downsides and raises societal dilemmas. At the same time, they positioned themselves as not being able to influence current trajectories. This was particularly visible in the way the healthcare inspector positioned himself. During the workshop, participants directed a lot of questions to him in an attempt to gain a better understanding of the Inspectorate's role and responsibilities. For example, the technology developer articulated his wish that the Inspectorate come up with rules for the introduction of self-tests on the commercial market, so that the presence of cowboy firms would diminish. The healthcare inspector answered:

01:10:38-5

> *IG: Now everybody is looking at me again. The role of the Inspectorate is a little bit overrated. The Inspectorate is always the last one in line. The rules are already made (…) The only thing we can do is state that the rules are not tenable.*

The inspector continued by articulating his dilemma with this position:

01:10:51-0

> *IG: Back-up physicians and hospitals and the like have umbrella organizations. Those umbrella organizations make agreements on what good quality consists of. They have to organize this themselves and we try to supervise this from a distance. The indicators that we have are incident reports (…) but that is at an enormous distance, so we miss out on a lot. A lot of things go wrong that we never know of. That's just the way it is. It's a given fact (…) and that is a pity once in a while.*

The professor-pharmacist positioned himself as a critical spectator in relation to the development of self-tests:

03:08:10-3

> *If we are able to canalize those tests with, indeed, the inspection (…) and provide good instructions and information, then I say: OK that is the best we can do, but I'm not too eager.*

Another interaction dynamic that was apparent and that was probably related to the way the participants positioned themselves in relation to the practice of preventative self-testing was that participants explored the practice of self-testing and its indeterminacies in a detached way, with

which I mean that they did not relate problematic issues to their institutional roles and responsibilities. Whereas participants in Workshop 1 in general spoke in the first person, participants in Workshop 2 often spoke in the third person. For example, the interaction sequence below, the person working at RIVM (J) and the pharmacist (S) relate self-testing to other developments in society:

01:03:25-1

> *J: (...) you should probably not consider the self-tests in isolation, but say okay, we have a society in which some people, or quite a few people, seem to demand self-testing, but what do they actually want? In fact, people do not want to know if there is something wrong with them, no, but if there is something wrong, they want (…)*

01:05:35-7

> *S: But what you also see, and that is a different societal issue, is that when there is, for example, a dismissal law, for the protection of employees, what you see at a certain moment is that it's being tampered with, and at a certain point, owning a house becomes very important. What you can do is point out the rules right away, but what you see is that a shift has occurred, that people have to take more responsibility, and also, don't just want to take more responsibility, but are forced to do so. Increasingly, people have to take care of their own needs (…) That is the way it works, and it is a consequence of individualism in society (…) Of course, you can deny this, but it is true.*

01:06:16-4

> *J: (...) but there are also many people who want to act in relation to something, or someone. If you think along this line about self-tests, then it might be a possibility, that it is not either-or, either with the professional or with the individual citizen, but that it might be possible for the professional to leave his office more often.*

01:07:14-4

> *S: The role of physicians will change. Back in the old days, you visited a physician and what the physician said was true. What you increasingly see is partnership, in the sense that the physician has the expertise that is needed to cure my body and myself. So a shift occurs, in the sense of you hiring a physician to heal yourself.*

Participants did not really question each other's views, roles and responsibilities (with the exception of participants questioning the healthcare inspector). Every now and then, the moderator attempted

to stimulate such an interaction, for example by summarizing the issues that were articulated and by explicitly inviting participants to relate these issues to their own daily practices or that of others. For example:

02:27:40-8

> *M: There is the question of a healthy society (..) and how citizens can claim a certain care based on tests (…) There is the point of commercializing self-tests and the rise of cowboy firms that lie on the border between what is appropriate and what is not (…) There is the point of interpreting the tests, and who does that? (…) Now try to point out what kind of responsibility this creates, especially given the development (…) and what it can imply for the responsibilities of others.*

Despite moderation, the general tendency in this workshop was to raise problematic issues in relation to self-testing. There was no interactive rehearsal on how to address these.

The activity of 'risking yourself' did not really occur during the workshop. In general, the emergent practice of self-testing was perceived by the participants as something that they could not influence and so they probably did not feel the urge to 'risk' their selves, and develop ways to address problematic issues. However, towards the end of the workshop, the healthcare inspector reflected upon his role and responsibilities by taking into account what he had heard in workshop:

03:29:17-0

> *IG: Considering this afternoon (…) Look, from the standpoint of the Inspectorate (…) I only see a limited role. I found the workshop really interesting, but regarding efficiency I ask myself, did I really hear a lot of new things that we can really use? Societal developments happen, by definition. This is the way our organization works; we can hardly anticipate these developments.*

We could say that the healthcare inspector performed the activity of action here. Not by articulating new or adapted roles and responsibilities, but by relying on his existing role while providing more articulation. During the workshop he expressed his role, responsibilities and dilemmas so others could respond. Towards the end, he shared his position again, thereby taking into account what he had heard.

Effects of the workshop in the real world

The participant working at RIVM and the healthcare inspector mentioned that they had learned something with regard to the technological artefact. They also stated that they had gained more insight into the field of home care devices, self-testing and healthcare and the different opinions and stakes that are involved. In the words of the healthcare inspector:

> *'I had the idea that the division we had, the idea of self-testing, point-of-care testing, home lab devices, that all that was quite comprehensible and that stakeholders could easily switch between them. But that was not the case at all (…) people were always heading off in the wrong direction. And that in itself is of course interesting, because if it is hard for us, the people in the workshop, to agree on this, then the societal and political discussion will of course, be even harder. And that I found an interesting observation.'*

Based upon this new awareness, the healthcare inspector also reflected upon his role in society with regard to these issues. It became clear to him that the Inspectorate had to communicate more and better in order for other stakeholders to understand the differences between the above-mentioned applications.

During the follow-up interviews, it appeared that participants had difficulties remembering the content of the workshop. This was visible in phrases such as 'um, I have to recap', 'it is difficult, it has been a while'.[110] Participants in Workshop 2 also did not actively relate insights from the workshop to their own work practices. When I asked the participants how they perceived the roles and responsibilities of others, and whether this had signalled challenges for their own daily practice, the participant working at RIVM explicitly stated that his work was not explicitly related to self-testing. One of the innovation consultants also responded in a similar vein. Rather than relating issues brought up by others to their own practices, the participant working at RIVM, the pharmacist and the developer of self-tests repeated some of the issues other participants had raised. The healthcare inspector, as mentioned above, did reflect upon his own daily practices.

[110] In the follow-up interviews for Workshops 1 and 3 these types of phrases were expressed to a lesser extent.

In summary

The table summarizes all possible public-sphere type interactions (cf. Chapter 2) and indicates which actually occurred. These will be discussed below and again in the final section of this chapter.

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.	
	Public-sphere type interactions	**Workshop 2 Self-testing**
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.	+
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.	+ - ++
Articulation	Articulation of emerging common, (public) issues	+
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks	-
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)	-
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation	-
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes	+

In this workshop the focus was on an emerging practice, not on a concrete nano-enabled device, as was the case for Workshops 1 and 3. As already indicated in the introductory section of this chapter, for this workshop the indeterminate situation was not as articulated as was the case for Workshop 1 (I will elaborate on this point further in the concluding section of this chapter). Because a clearly indeterminate situation was lacking, the scenario for this workshop had a different structure than the scenarios for Workshops 1 and 3. The scenario for Workshop 2 highlighted general trends and not so much changing values, roles and responsibilities. During the workshop, participants shared issues, dilemmas and stakes, but did not actively question each other's views, values and responsibilities. Moreover, the stakes and issues were often articulated in a general vein, not explicitly coupled to the participants' own roles and responsibilities, except for the healthcare inspector. Subsequently, it turned out that an interactive rehearsal was difficult to realize because participants did not position themselves as implicated in an emergent indeterminate situation. During the follow-up interviews, it appeared that participants had difficulties in relating the issues that were discussed to their daily work practices, except, again, for the healthcare inspector, as we have seen.

Section 6.3 Workshop 3 - The ECG patch

Real-world dynamics

Body-area-networks (BAN) refer to wireless networks linking wearable or implantable sensors and processors that constantly monitor physiological conditions – such as heart rate, blood sugar, brain activity and muscle tension – with the outside world (Jones, 2007). Thus, the monitoring and surveillance of the wearer of BAN is ambulant. The development of BAN is justified by reference to a vision of healthcare moving out of the hospital to care-at-a-distance (see previous section). This overall vision justifies investment in the development of BAN for care-at-a-distance, which is currently at an intermediate stage of development, with R&D, prototypes and some limited applications emerging (Parandian, 2012). There are some promise-requirement cycles, some on the technical side, as in the HUMAN++ project (where requirements on low energy use are driving R&D, see Penders, et al., 2007), others linked to the healthcare setting and integrating sensors, ICT and new responsibility arrangements.

An example of the latter is the wireless ECG patch for the 24/7 early detection of epileptic seizures based on the real-time monitoring of heart rhythm. As soon as unusual heart rhythm patterns are identified, an alarm goes off. One promise of the ECG patch is that it can detect some severe but inaudible and motionless seizures while the patient is ambulant, such that family members or caregivers might not need to observe the patient all the time. Expertise and care centres see benefits and have expressed the desire to commercialize the patch. Currently, a lot of attention is being directed to the optimization of the technology, such as the development of processors with better storage capacities using nano-electronics. Less attention is being paid to the changing roles and responsibilities that might accompany care-at-a-distance. For example, when the ECG patch sends out an alarm, who is responsible? A relative, a professional caregiver or someone who happens to be in the neighbourhood of the patient? And can a patient decide on their own not to wear the patch for a while? These issues were mentioned as problematic by stakeholders during the interviews that I conducted prior to the workshop. Those who were involved had different expectations, and they brought up different, sometimes conflicting, solutions to how to embed the ECG patch. For example, with regard to responding to the alarm, the specialist care centre Kempenhaeghe saw opportunities to allocate roles and responsibilities to home care centres, while a medical advisory centre based in Utrecht that is also involved in developing BAN for epilepsy, had the opinion that specialized centres such as Kempenhaeghe should extend their current roles and responsibilities.

Sociotechnical scenario and selection of participants

The developers of the ECG patch (a representative of the IMEC HUMAN++ project and a sector manager of 'treatment and long stay' at Kempenhaege), a representative of Philips (Philips also develops BAN applications), a neuroscientist working at Kempenhaege, a representative from a funding agency (ZonMw, which supports research trajectories with regard to creating care-at-a-distance) (see their Ambient Assistant Living programme, AAL), the Chair of a patient organization for epilepsy, a representative from AWBZ (which covers exceptional medical care, including treatment of epilepsy in specialized centres) and, finally, a healthcare practitioner working at Kempenhaeghe were all present. The three participants from Kempenhaeghe and the representative of IMEC were all involved in the clinical pilot of the ECG patch. The Chair of the patient organization did not know about the ECG patch prior to the workshop. His motive for joining the workshop was to hear more about the potential of the patch because he thought it could bring benefits for particular patients. Prior to the workshop, the representatives of Philips and ZonMw expressed a general interest in BAN.

Their motive for joining the workshop was to hear more about emerging ethical and societal issues. As the representative of Philips mentioned prior to the workshop:

> *'I think the workshop is interesting because it focuses on the societal aspects. The technology will be introduced, no doubt about that (...) but what is important in my opinion, is what the societal aspects of Ambient Intelligence are.'*

The representative of AWBZ repeatedly stated that the ECG patch and BAN, in general, were not yet a matter of concern for the organization. Prior to the workshop, participants received the techno-moral future scenario and a short description of the workshop. Text box 3 provides a summary of the narrative of the scenario. The narrative ('controlled speculation') starts with the above-mentioned indeterminate situation and explores possible new roles, responsibilities, values and norms arising as a result of the commercialization of the ECG patch.

Text box 3: Summary of the scenario: the dynamic relationship between identity and responsibility

At the end of 2010, the findings of the clinical pilots with the ECG patch are published in various journals and newspapers. As a result, expertise and care centres, as well as the patient organization, are contacted many times by patients and/or their relatives wishing to purchase the ECG patch. Patients and their relatives expect that the quality of their lives will improve with this patch. As a parent expresses: 'For years my husband and I slept badly because our 19-year-old son still sleeps in our bed. We are too afraid to leave him alone because he might have a severe seizure'.

The developers of the ECG patch want to commercialize it. The problem is that the cost of the patch and related equipment such as an alarm system are quite high and most patients cannot afford it. Insurance companies do not yet reimburse these costs, first and foremost because in their business model an alarm system is not a 'healthcare instrument'. Also, the Healthcare Insurance Board wants to have strict agreements with regard to access to and storage of the medical data. A steering committee on 'epilepsy detection' is currently calling for a revision of the criteria for healthcare instruments.

In the meantime (2011), the developers continue with the commercialization of the patch, now in collaboration with a software and telecommunication company. Several ECG patches, including the

accompanying alarm system have already been sold to individual patients. The patient organization also purchases a few patches to circulate among patients who do not have enough money to buy their own. With regard to responding to alarms, specialized care centres want to allocate responsibilities to local home care institutions. According to the specialized care centres, local home care can arrive more quickly. A requirement is that the patient should live within a radius of 10 km. Specialized care centres start to educate individual home care employees.

In 2012, an emergency occurs in the Achterhoek (a rural area in the eastern Netherlands). A patient has a extraordinarily severe seizure, called 'status epilepticus'. The ECG patch sends out an alarm. However, there is a delay and the home care agency only receives the alarm after 15 minutes. The employee does not know how to interpret the ECG data. He consults a colleague and together they interpret the data as 'probably just a regular case, but to be on the safe side phone the parents'. The parents receive the telephone call and go to the bedroom of their daughter and find her dead. They file a complaint with the medical disciplinary board. The incident receives a lot of media attention, and more complaints about the inadequacy of home care institutions are expressed in the media.

According to the developers of the ECG patch, the incident shows that adequate care-at-a-distance cannot be realized with just one application that monitors just one parameter. They decide to speed up the development of a broader, more extensive BAN that simultaneously measures parameters such as leg and arm movements. At the same time, the local home care institution, the telecom provider in Achterhoek and the specialized care centre are caught up in a legal battle about who is accountable, while the Healthcare Insurance Company and the Ministry of Health, Welfare and Sport discuss and reflect on the question: What are proper criteria for care-at-a-distance? The steering committee continues to lobby for the reimbursement of the patch and the related alarm system. Based on several pilots with BAN, including in elderly care, the Ministry of Health, Welfare and Sport decides in 2013 to apply BAN for 24/7 measurements. They perceive the 24/7 measurements as a way of cutting down the rising medical costs and enabling personalized care. The Healthcare Insurance Company decides to reimburse the costs. Both the Healthcare Insurance Board as well as the Ministry of Health, Welfare and Sport demand that as well as local home care institutions, medical professionals should also be accountable. Specialized care centres for epilepsy consider 24/7 video monitoring as a way to fulfil this new role of being held accountable. By using a video, a better estimation can be made by the provider of care-at-a-distance. The first body-area-

networks, including video monitoring, are introduced on the market. Over time, the patient organization receives complaints from patients about violations of privacy. A neurologist complaints about his changing responsibilities: 'The face-to-face contact with patients was my main motivation, now I just monitor and study ECG data'. Because the Dutch government is sympathetic towards BAN, it is now also used in other care settings, such as elderly care, and the revenue grows in 2014. Care providers are worried that the quality of care is diminishing and call for the restoration of face-to-face contact with patients.

Preparing and rehearsing futures: interaction dynamics in the workshop

During the workshop, participants explored issues from the scenario, such as video monitoring, the further development of a complete body-area-network and the possibility of involving local home care institutions to respond to the alarm. The participants did not question the desirability of these societal issues, but explored how they could be integrated with the further development of body-area-networks (BAN).

The overall thrust of the workshop was that BAN will be introduced into the healthcare system, and one should explore how to optimize this introduction. Factors such as market volume and scale were mentioned as important parameters to take into account. Below, two developers of BAN explore this issue:

00:26:42-8

> *IMEC: Market volumes are important to lower the costs.*

01:10:32-9

> *Philips: I want to respond to what have been said in the beginning of the workshop. Volumes were linked to technologies. Of course, a technology needs volume. But the solutions we are talking about here are often just servicing solutions. Technology does play a role in this (…). A lot of these services have a service infrastructure that requires a scale.*

The issue of volume and scale was explored further in this interaction. Philips and IMEC both provided information on their business models and expressed why sufficient volume and scale were

necessary for them. They both stated that they considered multistakeholder workshops such as this one, in which, for example, AWBZ and a patient organization were present, as an improvement, compared to traditional market research.

The pressure to reduce healthcare costs was seen as a major driver for the development of BAN:

00:57:56-7

> *Sector manager Kempenhaeghe: If we are talking about the development of a body-area-network, I think we are moving towards a more combined use with daily life. If we have a proper working system we can use a sleeping watch in a family replacement home instead of a night watch who is awake during the night. That is cheaper.*

During the workshop, a question-answer dynamic between the 'comparative selectors' (in particular AWBZ and ZonMw) and the developers and promoters of the ECG patch was visible. AWBZ and ZonMw expressed that they did not have much knowledge about BAN and epilepsy, and they asked for clarification. The developers and promoters of the ECG patch provided answers.

See for example in the interaction stretch below how ZonMw asks a question to gain more factual knowledge:

01:03:59-4

> *GB: Can I ask a question? Because I do not know anything about epilepsy. The possibility of intervening, is that with the help of medication?*

01:04:09-0

> *TG: Yes, to a large extent it is through medications. A small number of people can have surgery, but it depends on the type of epilepsy.*

01:04:12-3

> *GB: But what I mean is, if there is an alarm, what kind of actions should be taken? Should the patient take medication, or ... ?*

In general, the comparative selectors stuck to raising questions for clarification and did not express concerns and dilemmas from the perspective of their professional roles and responsibilities. The patient organization did bring up the experiences and dilemmas faced by patients once in a while. For example, the issue of parents living in constant fear, which imposes a burden on their relationship.
The moderator used this contribution of the patient organization to foreground the 'existential aspect' of living with epilepsy. He raised the question of whether in the long term the pressure to reduce costs in healthcare might lead to a situation in which patients experience a loss of quality of life. In response to this intervention of the moderator, the patient organization articulated what it saw as a problematic situation, namely the fact that BAN might lead to loneliness of patients, because with BAN, the face-to-face contact and personal relationships with caregivers decreases. The other participants affirmed that this might become problematic, and discussed the issue further in terms of exploring the needs of different patient groups (e.g. those who live in or outside a professional care institution, and those with or without an active social network) and how developers can adjust the functionalities of the ECG patch to different needs.

During the workshop, there was no explicit negotiation about what was at stake and what should be done. It appeared that the stakes of the participants did not differ that much, and there was an implicit agreement that the ECG patch would be introduced to the market and that this would improve the quality of healthcare for patients with epilepsy. This conviction probably led to the situation in which participants felt no need to negotiate.

Effects of workshop in the real world

I conducted follow-up interviews one month after the workshop to evaluate if and what participants had learned from the CTA+ workshop and if and how they were prepared to act upon insights they had gained.

All the participants valued the composition and orchestration of the workshop, although not every participant gained new insights by attending the workshop. The representative of Philips explained that they used similar formats within Philips:

'Philips also employs behavioural scientists and psychologists and we have these kinds of sessions on a regular basis (…). But the workshop was again a confirmation of the fact that BAN is very complex and that it is not clear who is going to pay for BAN, for example.'

The promoter of the ECG patch from Kempenhaeghe stated that he had not heard many new things during the workshop, partly because he already knew some of the participants. However, he did find that the scenario and the multilevel dynamics in it made him reflect on the situation:

'I found the scenarios we received beforehand quite stimulating (…) the idea that things can go wrong if you do not anticipate some issues.'

In the follow-up interviews, the representatives from AWBZ, ZonMW and the patient organization said that they had learned with regard to the technological artefact and with regard to characteristics of epilepsy. This is not surprising because during the workshop they expressed their lack of knowledge, and their 'modus operandi' during the workshop consisted of asking for clarification. Although the representative from ZonMw did not reflect upon her own role and responsibilities during the workshop, in the follow-up interview she did relate insights from the workshop to her own future role and responsibilities:

'Within ZonMw we are exploring the role of ICT within healthcare. This workshop provided concrete starting points for us at ZonMw about what types of issues we should pay attention to, maybe we should take these issues into account when formulating requirements for grant proposals. Within the AAL programme, I work with these kinds of issues, but the workshop made it more specific. When these smart technologies are introduced into society, although it is still not certain whether this will be the case, but if the products do enter the market (...) *then we should pay attention to the ethical aspects and not focus only on the financial aspect. This is something where we, as ZonMw, can play a role I think.'*

The developer of the ECG patch said that the workshop as well as the scenario made him aware of 'wider perspectives' and 'other factors'. During the follow-up interview, he considered if and how to take up insights in his daily practices:

'If your question is whether the workshop made me encourage my colleagues to change their approach? No. But I think creating a broader perspective around an application that is this complex, in

a rather efficient way and simultaneously bring stakeholders closer to one another, is a good thing. I think we should elaborate on that within IMEC.'

He also reflected upon his own role during the workshop and that of others:

'Maybe we were too dominant. We did not hear from the woman from the insurance company (…) and that lady from ZonMW spoke a few times, but was that enough?'

The sector manager for 'treatment and long stay' at Kempenhaeghe discussed the workshop and the scenario with colleagues and reflected on it during the follow-up interview:

'I think (…) that if we make a model for a certain service that we offer, we should spend some extra time on the questions around privacy. Issues around what you can and cannot prevent from happening, that sort of thing. That could, for example, be part of the agreement with the patient.'

In summary

The table summarizes all possible public-sphere type interactions (cf. Chapter 2) and indicates which actually occurred. These will be discussed below and in the final section of this chapter.

Assembling	Actors purposefully assemble to deliberate about and inquire into a common concern. The space for assembly is organized by actors themselves or by 'third persons'.	
	Public-sphere type interactions	**Workshop 3** **ECG Patch**
Deliberation	Actors in the space for assembly participate as knowledgeable actors, but are not necessarily knowledgeable about the same things.	-
Inquiry into indeterminacy	Symmetrical interaction: actors participating in the space for assembly share experiences, dilemmas, issues, stakes, sometimes putting themselves at risk. Questioning each other (probing): actors inquire into each other's realities through questioning present and future roles, responsibilities, mandates. There is some orchestration to stimulate interactivity and overcome impasses.	- - ++
Articulation	Articulation of emerging common, (public) issues	+
Anticipation	Actors put existing interpretative frameworks up for discussion and explore, in interaction, and in relation to indeterminacy, new or adapted interpretative frameworks	-
Negotiation	Negotiation of what is at stake and what should be done (e.g. which issues to consider as important)	-
Addressing indeterminacy	Interactive rehearsal on how to address problematic issues that are articulated, which will always include implicit and sometimes explicit negotiation	+
Aggregation	Articulated issues, stakes, concerns are taken together leading to overall outcomes	+

The composition of the workshop did not include all stakeholders, with users, such as patients and parents of patients, absent (although some were invited). I positioned the participants as implicated in the same indeterminate situation, albeit in a different way (see Section 6.4 for more details). Interestingly, AWBZ, and to a lesser extent ZonMw, did not see themselves as implicated in the emergent indeterminate situation. Nevertheless, they participated and, as it became clear, other participants, such as IMEC and Philips, did position these actors as part of the indeterminate situation (see Section 6.4 for more details).

The participants did not really probe each other's realities to acquire a better understanding of their visions, values or dilemmas. AWBZ and ZonMw asked questions for clarification with the aim of gaining more factual knowledge on the technical aspects of the ECG patch and the characteristics of epilepsy, for which the application might be a solution. Some of the other participants already knew each other (because they worked in the same care institution) so they probably knew each other's point of view already, or thought they did.

Section 6.4 Concluding Analysis

During the workshops and in the follow-up interviews it became clear that participants valued the composition and the design and orchestration of CTA+ workshops. Some participants even requested their continuation. Thus, it can be said that the organization of CTA+ workshops is legitimate. However, were they also effective with regard to the goals that were set? Was the set up of the workshop effective in creating public-sphere type interactions in relation to changing values, norms, roles and responsibilities? And what do the empirical findings imply for the design of CTA+ workshops as microcosms? Do the design requirements from Chapter 2 prove to be productive in practice?

In order to draw conclusions about whether and how CTA+ workshops designed as microcosms are good spaces, in the sense that they allow for public-sphere type interactions, I will proceed in two steps. First, I will briefly address the causal relation between the type of interactions that occurred in the workshops and the design conditions: Can the occurrence of certain interactions or the lack of them, be attributed to conditions that were, or were not, in place? Second, I will compare the results, and evaluate what they imply for the design of CTA+ workshops and the requirements formulated in Chapter 2.

A key point, of course, is that the three CTA+ workshops were not spaces for assembly as Dewey envisaged them, but were induced assemblies, designed and orchestrated by social scientists. Participants did not assemble on their own initiative but were selected and invited, based on a diagnosis of an indeterminate situation as developed by the organizer. The workshop itself offered a space for actors to inquire into the indeterminate situation, articulate problematic issues and develop and rehearse strategies that might help these issues be resolved.

Interactions in the workshops were explicitly moderated. However, this is exactly why I can explore the relation between the design of the spaces and what actually happened so as to learn what appears to work and what not.

Three assumptions guided the design of the CTA+ workshops. First, when those who are implicated in the indeterminate situation are selected and invited to participate this leads to active inquiry into the indeterminate situation (questioning each other, exploring entanglements) and the articulation of problematic issues because participants experience that there is something at stake for them.

Second, that when those who are directly involved in the indeterminate situation are explicitly invited to share their issues, stakes and concerns in relation to the indeterminate situation, this would stimulate perceiving own roles, values and responsibilities as partial and contingent, and leads to the exploration of new or more adapted roles and responsibilities in relation to issues and concerns brought up by others.

Third, the composition of the workshop (an approximation of a Deweyan ‘public’), combined with sociotechnical scenarios showing multilevel, multi-actor entanglements, leads to increased awareness about the evolving situation with regard to changing societal roles, vales and responsibilities, and a reflection on one’s own position, role and responsibilities in relation to evolving practices.

These design requirements could not always be realized. While this was a limitation in terms of achieving the project goals, it also created a natural experiment, an opportunity to see what happens if an important condition is not realized. Given the design assumptions as outlined above, and how I further specified them by drawing on the philosophies of Arendt and Dewey, I can analyse my findings in terms of two independent variables: the existence (and extent) of an indeterminate situation, and the adequate heterogeneity of the composition of workshop participants, reflecting

the variety of the relevant actors involved in the indeterminate situation. There is also an intermediary variable: the orchestration of the workshop and the actual moderation of the workshop process. The dependent variable, the desired outcome of the workshop, is quite complex, but its essence can be captured as action (in Arendt's sense) and inquiry (in Dewey's sense). As we saw in Chapter 2, the activities of 'action' and 'inquiry' are incorporated to a certain extent in my definition of public-sphere type interactions. Thus, when characterizing the outcomes of the CTA+ workshops in terms of action and inquiry, these concern the type of interactions that occurred (or not). The Table below summarizes the results for the three workshops:

Table 1

	Indeterminate situation?	**Adequate heterogeneity?**	**Orchestration**	**Outcomes (summarized)**
Workshop 1	Yes	Yes	Yes	Some action & inquiry
Workshop 2	No	A little	Yes	Some action, no inquiry
Workshop 3	Yes	No	Yes	No action, no inquiry

Before I analyse these findings, I will briefly indicate the reasons for the scores on 'indeterminate situation' and 'adequate heterogeneity'.

During the preparation of Workshop 2 – point-of-care-devices for self-testing in home settings, with a special emphasis on 'high-risk tests' – it appeared that there were not many different stakes, in the sense of the presence of actors out there that position themselves explicitly against self-testing in home settings. The stakes that were present primarily revolved around the issue of regulation: Should high-risk tests be provided to people with or without the involvement of a pharmacist or medical expert? The issue of regulation was already on the agenda of those involved, such as the Healthcare Inspectorate, NEN and the Ministry of Health, Welfare and Sport. At the time of the workshop, in 2010, the issue of regulation was already being inquired into at the national as well as the European level. In this sense, the issue of regulation appeared not to be that indeterminate: lines of action for how to deal with the different stakes with regard to regulation were already outlined and being acted upon.

For Workshop 1, the lithium chip, as well as for Workshop 3, on the ECG patch, there was indeterminacy. In the worlds of lab-on-a-chip devices, as well as body-area-networks (BAN), the first

pilot tests had been done with patients, and those who were involved (e.g. patients and/or their parents, caregivers, developers, insurance companies) had different stakes, views, issues and concerns with regard to how to further develop and embed the nano-enabled device. Moreover, sometimes these different stakes, values and concerns 'out there' were already recognized by actors.

In the composition of Workshop 3, these different stakes were not visible, because it turned out that the adequate heterogeneity could not be realized. In this workshop, four of the eight participants were involved with the development of the ECG patch and their stakes and views were more or less the same: the ECG patch would be introduced to the market and the delegation of the tasks and responsibilities to local home care would be adequate to embed the ECG patch. The other actors present in the workshop positioned themselves from the outset (already during the interviews I held prior to the workshop) as not directly involved in the indeterminate situation, but they mentioned that they were interested in the general dynamics of care-at-a-distance and the societal impacts and, as such, were interested in participating in the workshop. I invited those that I identified as directly implicated in the indeterminate situation, such as patients and/or their parents and the Healthcare Insurance Board (CVZ). While they expressed an interest in the workshop, they did not participate.

One clear, even if preliminary, conclusion from Table 1 is that adequate heterogeneity in the composition of workshop participants is necessary to achieve the desired outcomes. In Workshops 1 and 3 there was a recognizable indeterminate situation and a variability in composition, which led to a difference in outcomes. When there was no recognizable indeterminate situation, as in Workshop 2, there was some action (in Arendt's sense), probably related to the somewhat heterogeneous composition of the workshop, but no inquiry. Thus, a combination of an indeterminate situation and heterogeneity in the composition of participants is necessary to stimulate action as well as inquiry. Table 2 summarizes the analysis that leads to this conclusion.

Table 2

	Indeterminate situation: yes	Indeterminate situation: no
Heterogeneity: yes	W 1: some action & inquiry	
Heterogeneity: inadequate	W 3: no action, no inquiry	W 2: some action, no inquiry

As the analysis is only based on three cases it must be tentative. It can be supported, however, by the findings of Parandian (2012). Parandian developed different designs of CTA workshops so as to be

able to compare and determine the effects on learning for a number of dimensions: reflexive articulation, learning about each other's realities, and learning about dynamics at the collective level (Parandian, 2012, p. 41-43). In particular, his conceptualization of reflexive articulation, which can occur through a process of argumentation and aggregation, shows a resemblance to Arendt's notion of action. In the words of Parandian, 'reflexive articulation [means] that different arguments and points of view in relation to a specific issue or dilemma are considered which help individuals to come to a more reasoned decision about action alternatives' (Parandian, 2012, p. 42). One of his analyses concerned the effect of adequate versus inadequate heterogeneity on the occurrence of reflexive articulation. His findings indicate that when there is adequate heterogeneity, reflexive articulation is encouraged (Ibid., p. 258).

While the overall conclusion about the need for a combination of a recognized indeterminate situation and an adequately heterogeneous composition of workshop participants is plausible in its own right, and has further support from the evaluation of the CTA workshops prepared and organized by Parandian (2012), it still involves some reduction of complexity. Thus, it is important to consider some aspects of the findings in more detail.

I will start with a closer look at how and why the activity of 'action' occurred in Workshops 1 and 2, which will lead me to identify the importance of the articulation processes that were set in motion, whether visible immediately in terms of Arendtian action or not. The first question is whether it was contingent that the action occurred. Perhaps it was individual style or an unexpected intervention, or a combination of opportunities provided by the realization of the design requirements on the one hand, and contingencies involved in individuals picking up on opportunities on the other. In Workshops 1 and 2, there were opportunities to act (in Arendt's sense). In these two workshops, every participant could and did share his or her stakes, questions and dilemmas, some more than others. The moderator also encouraged (as in all workshops) silent participants to share their perspective. This then led to articulation processes of various forms, as I will show.

In Workshop 1, the psychiatrist was willing to risk his identity and consider other roles and responsibilities, the essential element of Arendtian action. He recognized that there was much at stake for him: use of the lithium chip would have implications for the division of responsibilities and his traditional mandate. The patient wanted to use the chip at home and make his own decisions. The psychiatrist was reluctant, but did discuss other situations in which patients could make decisions, as long as they were agreed by him. In Workshop 2, the healthcare inspector was the

target of questions from other participants about his possible role and he responded by articulating his position in an open-ended way (although returning to his traditional role at the end of this discussion when the moderator asked whether he would explore a new role).

These two instances of action in Arendt's sense (1998) stood out because views were usually offered as input into the discussion, rather than being modified in response to the opinions and experiences of others. However, the fact that little risk taking is visible in the interactions during the workshops does not imply that participants do not articulate new roles and responsibilities and learn because of the workshop. Parandian (2012) notes that participants need not always interact but can learn from observing: 'in a sense participants are players on a stage within the space of the workshop: They can actively engage in deliberation, but also sit back from time to time' (Parandian, 2012, p. 274).[111] What also happens is that learning is explicitly articulated only after the workshop. This was visible in the post-workshop evaluation by the lab-on-a-chip professor (see Section 6.2). During Workshop 1 she was not very interactive and did not anticipate possible new roles (other than mentioning that the issues discussed in the workshop were new to her). After the workshop, however, she wanted to create more awareness of these issues in her world of research on lab-on-a-chip. Similarly, Parandian (2012) notes that:

> *'Learning may not be visible during the interactions as they occur. Actors will present their positions, responsibilities and accountabilities in their professional roles in the real world, and retain them in further interaction. While they might push their own perspective during the actual conversations, they might at the same time reflect on their own goals and strategies on the basis of what they hear in the workshop.'*

He offers an example where a participant (from an SME) pushed his traditional role during the workshop, but was already considering other possibilities for himself, and mentioned in the post-workshop interview that he would follow that up.[112]

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[111] Parandian (2012, p. 238) offers the example of a debate between a healthcare professional and a health insurance representative. The healthcare professional voiced strong concerns about the plans of healthcare insurance companies to use aggregated (medical) data generated by BAN, positioning them as only interested in reducing costs without considering quality. While this interaction did not continue for long, it was an opportunity for other participants to observe the responses, and so gain more insight into the real-world concerns of actors in different positions (as these came to life in the microcosmos of the workshop). This is visible in how a scientist, during the post-workshop interview, reflected on this part of the conversation: 'I did not know that there was such a lack of trust on the part of healthcare professionals about the incentives of healthcare insurance companies. I had recognized this in the scenarios, but now it was taking place in real-time during the workshop discussions'.

[112] For example, the SME stated the following during the post-workshop interview: 'In our company we have sessions where we discuss strategic matters, we think about functionality issues but mainly about requirements for getting our

What we see here is more than action (in Arendt's sense) occurring during face-to-face interactions. While this remains important for Arendt, she also recognizes the importance of articulation processes started in face-to-face interactions, which then enable enlarged thinking and later action (in the strict sense in which Arendt speaks about 'action', as well as in commonsense terms, as when the lab-on-a-chip professor organized a session on social aspects during a lab-on-a-chip conference). Whether or not articulation processes are initiated and continue later will depend on many other things besides what happens during a workshop, but it is important to recognize this phenomenon for its value in designing spaces for assembly in general, and CTA+ workshops in particular. One possibility would be to make more explicit to the participants the value of reflective inquiry type interactions.

In Workshop 3 there were no clear instances of action in Arendt's sense. Opportunities were created by the moderator, but it appeared that the lack of adequate heterogeneity (no intermediary actors, only technology developers and comparative selectors) led to a particular style of interaction. There was deference towards the enactors as the knowledgeable parties with regard to this new technology: tell us what is the case with this new technological option. A receptive attitude, where comparative selectors articulated their own visions, values and dilemmas was only apparent to a limited extent. The question-answer pattern that resulted meant that the enactors were not exposed to other visions and values, to which they would have to respond, or at least take into account, during the workshop or later. Nevertheless, there are indications that some articulation processes were initiated, because in the post-workshop interviews, participants from Kempenhaeghe and IMEC reflected on possible future roles and responsibilities. Other participants, in particular the representative from AWBZ, who considered herself as not really implicated, said that the workshop had taught her about the technical options, not about possible roles and responsibilities – which was too distant for her.[113] There may have been a missed opportunity here to start articulation processes

products introduced into the market. Having experienced the interactions in the workshop, I see that other actors have a different approach than ours, and I tried to make this difference clear in the workshop. But I also realized that they also assess other, broader aspects! The quality of a service was an important example! What the healthcare professional was saying about her world was really interesting. They really have a different perspective than ours. I will take these insights with me to the next meetings in our company' (Parandian, 2012, p. 279).

[113] I note that this is a general feature: when participants see themselves as distant from the ongoing technological development they do not consider their roles and responsibilities but want to learn about the new technological options. In the follow-up interviews for Workshops 1, 2 and 3, actors with roles and responsibilities to compare and select new technology developments stated that the scenario, as well as the composition of the workshop, increased their knowledge about the nano-enabled application and its possible functions. This is not surprising when taking into account the way in which new technologies are developed. New technologies are developed in institutionally protected spaces (for example, start-up firms and laboratories), which implies that during the R&D phase 'comparative selectors' have no insight into what is being developed.

upon which, in principle, better (that is more reflexive, more encompassing) decisions can be made, because other participants did see AWBZ as implicated and would have liked to inquire into its future role.

A further feature of interactions and their outcomes starts with the importance of multilevel, multi-actor dynamics, important for CTA but also in my overall conceptual framework (Chapter 1). The creation of sociotechnical scenarios made such multilevel, multi-actor dynamics visible and this raised awareness, particularly for enactors. In the post-workshop interviews, enactors reported that their awareness of such dynamics was primarily raised by the scenarios and not so much by the actual exploration and reflection on them during the workshop. This accords with Parandian's finding that 'a common theme in the appreciative responses was the eye-opener effect of seeing more actors and interactions at play' (Parandian, 2012, p. 273). The term 'eye-opener' is interesting because it indicates a psychological effect, which may set an articulation process in motion somewhat independently of actual interactions. It was also explicitly used by the lithium-chip developer during her post-workshop evaluation (Section 6.2).

An important aspect of multilevel, multi-actor dynamics is the possibility of considering divisions of roles and responsibilities other than the present one and making that part of the discussion. Parandian (2012) notes that for his workshop on BAN there were instances of reflective inquiry in which 'positioning statements were made in which roles and responsibilities were delegated to different actors' (Parandian, 2012, p. 217). This can then lead to anticipatory and somewhat open-ended negotiation. As he phrased it: 'the participants of the workshop use the platform of the workshop to allocate roles and responsibilities to each other through exchange of positioning statements' (Ibid., p. 225). While this is not my main point in this concluding section, it does show how one feature of good spaces, the possibility of negotiation, can actually take shape. As in Parandian's workshops, my CTA+ workshops were not designed to push negotiation activities, so I could only observe this possibility when positioning statements were made and there was a response.

Reflecting on the findings and conclusions, some suggestions about preparing and organizing a CTA+ workshop and good spaces for assembly more generally can be made. A recognizable indeterminate situation and adequate heterogeneity were identified as effective design requirements to enable action (in Arendt's sense) and inquiry (in Dewey's sense). This creates a problem, however, when NEST is the topic of the exercise. Those implicated in the indeterminate situation have to be present

in the local space for interaction, and they have to recognize themselves as implicated in the indeterminate situation. At the same time, the aim is to take future developments, even if uncertain, into account, in which more actors will be implicated than at an early stage of the R&D and product development trajectories. For newly emerging technologies such as nanotechnology the situation is quite open-ended, particularly as to its eventual embedding in society. Thus, it will not be clear to the various actors who it is that is implicated and should be present. I mentioned the position of the AWBZ in Workshop 3 above. Here, the analyst could and should contribute, on the basis of a general understanding of innovation and societal embedding trajectories, and an empirical diagnosis of the dynamics of the concrete situation. This proactive role of the analyst was emphasized by Robinson (2010) and Parandian (2012) with respect to their CTA workshops. For CTA+ workshops, there is the additional consideration of ensuring action and inquiry. The latter, as we saw, implies that participants should see themselves as implicated and are able to articulate roles and responsibilities for themselves and others, otherwise the interactions would be limited to information exchange. The challenge for NEST is to anticipate future developments and allow learning about them, including learning about possible roles and responsibilities. However, not all actors who might be implicated in the future situation feel implicated in the present, open-ended situation. Optimizing for one goal, anticipation, may therefore make it difficult to optimize for the other goal, action and inquiry. The two goals cannot be fully achieved simultaneously in one CTA+ workshop.

This conclusion may lead to speculations about the possibility of having two CTA workshops (or a workshop lasting longer than four hours), the first emphasizing anticipation, the second action and inquiry. Such a separation, although not in exactly those terms, is well known from focus groups and other public engagement exercises, where information is provided before actual discussion can start. In my suggestion, it is not just information that should come first but learning to anticipate, and doing so in interaction. What should be considered carefully is the effect of this on articulation processes, which I identified as important to achieve the desired outcomes.

Another way to address the trade-off that I outlined is to increase the input of the organizer, for example by compensating for the absence of actors that might be implicated in the future but do not see themselves as implicated yet (or are just absent for contingent reasons). In creating the sociotechnical scenarios, the CTA analyst can ensure that the variety of actors implicated in both the present and the future is visible, to sensitize the participants to this variety and, as a reference, to invite participants to think about actors others than those present, and present and future roles and responsibilities. There are other ways to sensitize participants, for example by role plays in which

participants take a role other than their own. This would, however, do away with the notion of reflective inquiry and its implications for own roles and responsibilities. Thus, there is no golden way of achieving both sets of goals for good spaces for deliberating on NEST. However, one can work on both goals, accepting less than full achievement. The trade-off that will have to be made must take the situation into account, including how much experience there is with CTA+ and other 'good spaces' exercises.

Occasion to extend the public sphere?

The CTA+ workshops were relatively successful in that they were appreciated by the participants and showed instances of 'action', 'inquiry' and articulation processes. In terms of requirements for the design of good spaces, the productivity of spaces turned out to be linked to the specificity of the topic and what was indeterminate about it, recognizable stakes for the participants and adequate heterogeneity in the composition of the participants. This creates a problem for drawing conclusions about a possible extension of the public sphere to include deliberation on NEST. The public sphere is meta-topical, thus non-localized and unspecific; it is about overall deliberation, general competences and the affording of local topical spaces. What is productive for topical spaces may not be helpful for a well-functioning public sphere, even while depending on such topical spaces. General competences in sociotechnical critique (as in the better forms of science journalism), the equivalent of literary critique and art critique, will be important. Such a competence will be helpful in concrete topical spaces as well, but there dedicated inquiry and interaction between different kinds of actors will be just as important.

Two directions can be followed to address the problem. One is to consider that CTA+ workshops and similar exercises not only become more widespread, but are seen as important, also to address NEST in general. By implication, this would create a situation where NEST can be addressed more readily and more productively. Building blocks for an extended public sphere would be in place. The other direction is to start with requirements for an extended public sphere. I will come back to this question in my concluding chapter. Below, I will only formulate some thoughts drawing on the findings and analysis in this chapter.

There is more to build on than the CTA+ workshops discussed in this chapter. They were part of a broader effort, the Dutch Societal Dialogue (see Chapter 5). Moreover, they were not the only

examples of CTA initiatives. CTA workshops and related activities by PhD students and staff in the TA NanoNed Programme are now recognized and accepted in the nanoworld.[114] CTA activities are also occurring in relation to other newly emerging technologies such as genomics and synthetic biology (see for example Roelofsen, 2011). And in Codes of Conduct for nanosciences and nanotechnologies, especially the 2008 proposal of the European Commission, one recurrent item is transparency, a key condition for public-sphere type interactions. In general, there is a move towards inclusive governance (see Chapter 1 and Chapter 4) and different proposals and initiatives for deliberation on emerging technologies have been suggested, including the Converging Technologies for the European Knowledge Society (CTEKS) proposal in Nordmann (2004).[115]

For the CTA+ workshops themselves, one can imagine that versions of such workshops will be organized and do better with the benefit of my analysis in this chapter and in this Thesis as a whole. They already have some visibility through some of my publications and because of an interest in them from ethicists and sociologists working on the newly fashionable issue of Responsible Research and Innovation (see Fisher & Rip 2013 for an overview). In the framework of the Dutch National Dialogue, when discussing conditions for a successful dialogue, the CIEMD (2011) noted the value of the approach in its final report (p. 21):

> *'The dialogues on concrete products (lithium chip, self-testing with the help of lab-on-a-chip, (…) and wireless ECG patch) went well (…). It turned out that organizing interactions in a focus group with stakeholders concerned with concrete products had many advantages. The fact that there was a product to which participants could relate, provided a different starting point for interaction: here there was something at stake, and so the dialogue was more concrete and engaged. Sociocultural issues occasioned by new technologies were more often a topic for discussion in dialogues on concrete products.'* (translation by author)

It is a passing remark, in the sense that the Committee was not in the business of pushing particular approaches. However, their Report could become a resource to be drawn on by others, also at the collective level.

[114] See for an evaluation, Robinson (2010, Chapter 6) and Rip & Van Lente (2013).

[115] This is the report of an EU High-Level Expert Group considering the European response to the US interest in, and push towards, NBIC convergence and the brave new world it will realize for us. As Nordmann phrases it: 'Since the acronym CTEKS does not refer to any specific configuration of technologies, and since it does not single out any specific common goal upon which these technologies converge, it designates only the deliberative process through which the convergence is organized. According to the CTEKS designation, these deliberative processes have as their goal the European knowledge society—that is, a society of Europeans who are jointly embarked on the project of solving problems and reforming their world and who place knowledge production as well as technical innovation in the service of this project' (Nordmann, 2009, p. 290). However, this reads like a project to extend the public sphere to include NEST. Little specific follow-up has occurred.

Whether spaces for assembly, enabling public-sphere type interactions, will continue to be organized will also depend on affordances available at the level of institutional regimes, for example when relevant organizations, ranging from science institutions to branch organizations in various industries, will show increasing interest in having interactions with civil society. While one sees indications that there is a move in this direction, this is tentative, and the main position remains one in which developers and promoters of new science and technology feel they can limit themselves to occasional participation in dedicated local spaces for interaction. On the other hand, there is pressure – from policy and with regard to maintaining credibility – to engage in such interactions, and philosophers and social scientists are keen to contribute.[116]

With these last remarks, I am already moving towards indications of the emergence of an extension of the public sphere. There is discussion of the justification and value of specific exercises in relation to the challenges of newly emerging science and technology, the roles and responsibilities of various actors and the values that should be considered (and possibly newly articulated). This discourse then enables general deliberation on NEST, as well as providing an affordance for further such exercises. The other element of such an extension of the public sphere is the growth of general competences in what I called sociotechnical critique (similar to art critique): to appreciate new technological options and their embedding in society, not necessarily to criticize them as wrong or misdirected but to explore, anticipate issues and assess them. In the CTA+ workshops, there was some learning in this respect, but it was very focused on the specificities of the domain and may remain limited to the people involved in the workshop. One can see the possibility of generalization, and in some focus groups on nanotechnology one sees participants come up with narratives about new technology generally (cf. Throne-Holst 2012: 'new is risky; old is risky too, new is risky but has advantages'). Such narratives may draw on general cultural repertoires in our society and reproduce them. However, some learning occurs as well. Perhaps a productive way forward would be a combination of such cultural learning and the dedicated deliberative processes Nordmann and his collaborators envisage for the further direction of converging technologies (Nordmann 2004, 2009). This would require other kinds of spaces than those discussed in this chapter, but their design may profit from my findings and analysis.

[116] See Fisher & Rip (2013) for an overview in terms of Responsible Research and Innovation discourse, and interventions by philosophers and social scientists in STIR and CTA projects. For scientists and technologists, it might appear as a monstrous alliance, trying to distract them from their real mandate: to develop science and technology for the benefit of humankind.

Chapter 7 In conclusion

Introduction

Involving civil society actors, such as civil society organizations (CSOs), as new dialogue partners in the development and governance processes related to newly emerging science and technology (NEST) is one of the ways in which Western societies are trying to become more reflexive about NEST and the potential societal issues it raises. To advance our understanding of this handling of new technology through the involvement of civil society actors, this thesis has studied four novel 'spaces' (spaces not only as through their geographical or physical characteristics, but also as various kinds of openings, offering affordances) in which newly emerging nanotechnology was a topic for deliberation between civil society actors and actors with institutional responsibilities to develop, promote and embed nanotechnology. The spaces studied differed in design, orchestration, topics and aims. I chose to study a variety of spaces to obtain an idea of the possibilities presently available in our society for these groups of actors to assemble and deliberate on newly emerging nanotechnology. This empirical study has assisted in addressing the research question of this dissertation concerning what can count as good spaces in which newly emerging nanotechnology and its related emerging societal issues can be a topic for deliberation, negotiation and aggregation. This question is also linked to a design question: how might we create and orchestrate such spaces?

Section 7.1 will address my research questions based on the analysis in the four empirical chapters. The individual chapters focused on the specifics of each individual space for interaction and analysed each space separately to determine whether and how public-sphere type interactions were realized. This section steps back from the specifics of the cases to gain an overview of the results and to identify the conclusions that can be drawn about requirements for good spaces that allow for public-sphere type interactions. This has to take the broader context of which spaces are part into account. The relation between local spaces for interaction and the broader context is visualized in Figure 2. Each of the inner circles represents a local space for interaction. The outer circle shows the affordances and constraints that are currently present in our society for such local spaces to function.

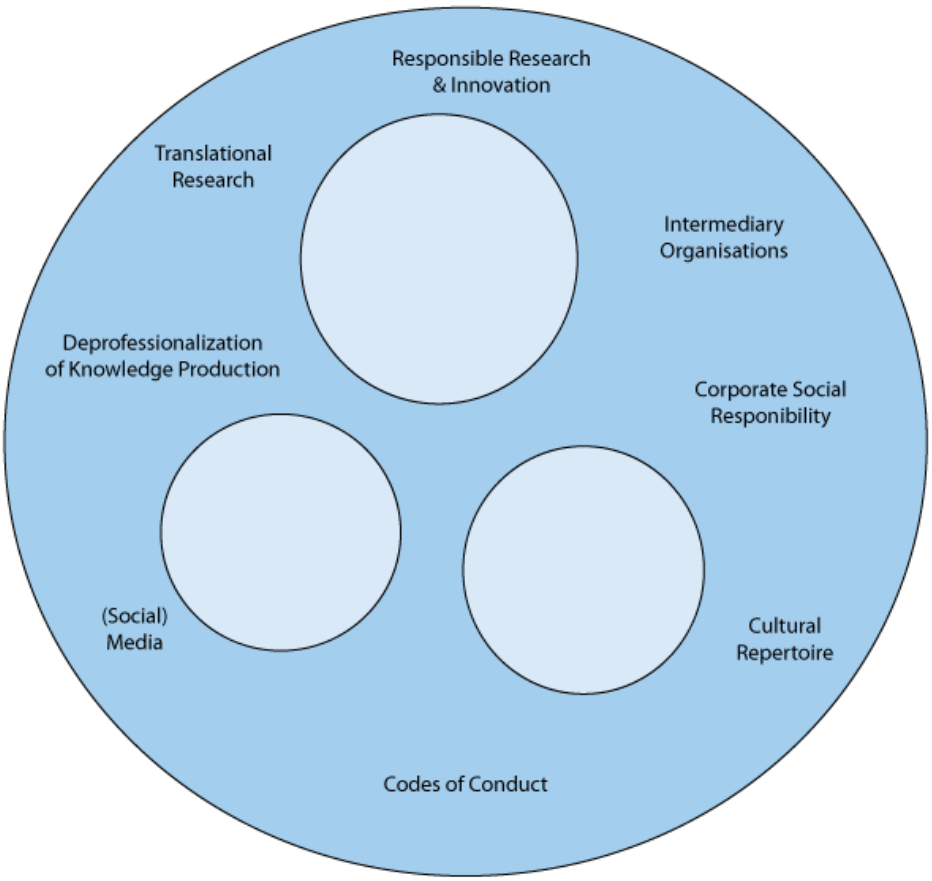

Figure 2: Some local spaces for interaction in a context of common affordances and constraints

The requirements developed in 7.1. encompass both the design of local spaces and their relations with context. They can be taken into account by those responsible for the organization and design of spaces for interaction, like policymakers, or consultancies, but the requirements also have implications for productive roles and responsibilities of technology developers, and civil society actors.

Section 7.2 will situate the analysis in the broader context of Western societies that are opening up to inputs coming from civil society actors in managing newly emerging technology in society. An important question here is how far this amounts to an extension of the public sphere where NEST can be addressed. This is a complex question because it requires some idea of the characteristics of such an extended public sphere. However, these characteristics are not pre-given and cannot be simply extrapolated from the characteristics of the public sphere as we know it. In fact, the characteristics are ultimately the outcome of a process of stabilization of emerging patterns (just as the characteristics of the traditional public sphere are the outcome of processes of stabilization from

the eighteenth century onwards). Nevertheless, I can identify, even if tentatively, the characteristics and conditions which need to be fulfilled.

Section 7.3 will offer a brief evaluation of how my thesis argues for an overcoming of the limitations of present civil society engagement and, in doing so, assumes that civil society engagement is a good thing to have in managing NEST in society. However, this may not always be the case. I will conclude by briefly reflecting on reasons for non-engagement.

Section 7.1 Productive spaces for assembly where NEST can be a topic for deliberation

Each of the four spaces for interaction studied were different. In each space, nanotechnology developers and civil society actors assembled in a particular way, and each space stimulated particular forms of interaction and collaboration. This implies that I cannot compare the spaces feature by feature, but rather should trace the similarities and differences between them. There is a difference between spaces where a concrete product is envisaged, such as a risk framework in the case of DuPont and EDF (Chapter 3) and capacity building in the case of NanoCap (Chapter 4), and spaces where deliberation (or sometimes simply communication) is the main aim, as in the projects organized during the Dutch Societal Dialogue (Chapters 5 and 6).

Even when the realization of public-sphere type interactions is not an explicit aim, they can still occur. The fact that a product has to be achieved stimulates processes of deliberation, of negotiation about what is at stake, and it leads to aggregation because issues and stakes articulated during the project have to be considered together in an outcome. This was visible in the cases in Chapters 3 and 4. For the collaboration between DuPont and EDF as well as for the NanoCap consortium, the occasion to start the project concerned indeterminacies with regard to potential hazards and the governance of engineered nanoscale materials and engineered nanoparticles. Both projects created a protected space that allowed productive interaction to occur. This required confidentiality (about the production processes, in the case of DuPont and EDF) or exclusion (in the case of NanoCap, no outsiders who could interfere could be present). The participants were free to consider which topics deserved to be on the agenda in their protected space, within the bounds created by the agreement about the overall purpose of the project. From the point of view of public-sphere type interactions this can lead to a limited scope in the deliberation. For example, in both projects the environmental

NGOs emphasized that it was not part of their job, that is, their self-styled mandate, to consider the broader ethical and social aspects such as the nanodivide, or changing roles and responsibilities. In the case of DuPont and EDF, there was joint inquiry and probing of identities. In the case of NanoCap, there was less occasion to do so. Public-sphere type interactions only occurred between the environmental groups and between the trade unions when they had to articulate their positions.

Reflecting on what occurred, it can be noted that the collaboration between DuPont and EDF, and the NanoCap project, were one-off affairs, in the sense that participants could go their own ways as soon as the projects concluded. Nevertheless, the results of these projects are visible and referred to by various actors.[117] Thus, there are effects at the collective level, that is, at the level of a publicly available repertoire of symbols and routines (see Swidler 1986, as discussed in Chapter 2), and, as part of the available repertoire about newly emerging nanotechnology and its embedding in society, these effects can be mobilized by other actors in different contexts to support and shape their actions.

Capacity building for civil society actors to facilitate its role as a new dialogue partner remains on the agenda, but is often reduced to raising awareness and improving understanding of the new technology (see also Chapter 5 on the eventual approach taken by the Committee for the Societal Dialogue). While this is important, giving capacity building priority may lead to the postponing of actual deliberation between civil society actors and technology developers, such that the structural asymmetry continues. The corollary is that actors with institutionalized mandates and roles to develop newly emerging nanotechnology can limit their own competence building to science communication training.

The other two case studies of spaces for assembly, the Dutch Societal Dialogue (Chapter 5) and the CTA+ workshops (Chapter 6), had deliberation as an explicit aim. They were initiated and to some extent designed by the Dutch government and a specially appointed Committee (CIEMD) and by social scientists, respectively. There were bottom-up dynamics, in the sense that proposals for

[117] For example, the International Organization for Standardization (ISO) has built on the risk framework to develop their own guidelines (ISO/TR 31321) for nanotechnology-nanomaterials risk evaluation http://www.iso.org/iso/catalogue_detail.htm?csnumber=52976. NanoCap members are being invited by governments and branch organizations to share their knowledge on risk and hazard identification in engineered nanoscale materials. In 2011 for example, the project leader of NanoCap (Van Broekhuizen) in collaboration with the Confederation of Netherlands Industry and Employers (VNO-NCW) organized an internal workshop on nano reference values (see Van Broekhuizen, 2012).

projects could be submitted to the CIEMD, although the initiators of these projects were often mediating agencies. Although it were special cases because of the induced assemblies, it can be considered that in general some mediation is necessary and resources are required to support deliberation initiatives (cf. Dewey on the role of 'officials' who articulate indeterminacies and identify publics, see Chapter 2).

The Societal Dialogue, an explicitly multilevel configuration, was originally set up by the Dutch government to extend – using my terminology – the public sphere in Dutch society by enabling opportunities for civil society and developers of nanotechnology to assemble, inquire into and articulate broader ethical and societal aspects, and not only risk issues. Ultimately, however, risk issues remained the main topic in more than half of the projects carried out as part of the Societal Dialogue, possibly because they appeared to be more tangible. The style of interaction in the majority of the micro-level spaces was open-ended: there was not much at stake for participants other than to receive information from the world of nanotechnology. However, there were local spaces where emerging societal issues were a topic of inquiry. These spaces were designed and orchestrated for that purpose, including inputs such as vignettes and scenarios. Thus, the organizers of these spaces were already articulating the emerging indeterminate situation. Analysis of the projects, together with an in-depth analysis of the CTA+ workshops, indicates that an essential requirement for productive interaction is the combination of an indeterminate situation recognizable as such for participants, as well as adequate heterogeneity among the participants, reflecting the variety of relevant actors associated with the issue.

It is not quite clear what effects the Societal Dialogue had. The formal report to the Dutch government emphasized the outreach and improved awareness that were achieved, and the government accepted the report. There will be effects for the participants in the project, but this is one further input into their overall exposure to nanotechnology in the media. They may well be more attentive now, and better able to assess what they hear and see. Reference to the Societal Dialogue as a whole is limited because there are little or no substantial results to which to refer. However, the fact that it occurred and that there were no conflicts may be taken as an indication that it was a fairly successful example of an instrument of inclusive governance for newly emerging science and technology, at least in terms of awareness building and some deliberation.

The CTA+ workshops were set up by social scientists as an explicit occasion for actors to inquire into and anticipate changing values, roles and responsibilities in relation to the development of nano-

enabled applications in healthcare that support the novel practice of care-at-a-distance. The CTA+ workshops were protected spaces to ensure that participants felt free to explore their own and others' positions and ideas. This is what occurred, even if 'inquiry' (in the sense of Dewey) and 'risking oneself' (action in the sense of Arendt) occurred only occasionally. As noted above, in general, the key condition for stimulating public-sphere type interactions in the microcosm is the combination of the recognition of the existence of an indeterminate situation and adequate heterogeneity in the composition of participants.

The CTA+ activities occurred within the framing of the Societal Dialogue, but were part of a broader set of activities in CTA for nanotechnology and to some extent other newly emerging science and technology. The acceptance of such activities in the world of nanotechnology was one of the achievements of the Dutch TA NanoNed research programme (Rip & Van Lente, 2013). This demonstrates the increasing recognition of societal issues on the part of technology developers as well as research funding bodies and policymakers who push the need to anticipate on the embedding of nanotechnology in society so as to be able to make better informed, more reflexive decisions. In relying on CTA workshops and other activities, in a sense, technology developers and research funding bodies delegate inquiry and deliberation to the organizers and participants in the workshops. While this may be a good strategy, the question of how to apply the results of such workshops in on-going strategies and decisions remains.

Reflecting on these first-round conclusions, it is clear that the question about good spaces for interaction, raised in the introduction of this thesis and then pursued in the empirical chapters, cannot be answered in an instrumental way ('Do X and then you will achieve goal Y'). There will be uncertainties of various kinds – that is, indeterminacies, but in this case about how to design good spaces – to be resolved, and every situation may require its own approach. Keeping the four different spaces for interaction in mind, general requirements for good spaces that allow for public-sphere type interactions between nanotechnology developers, civil society actors and others, can be formulated. These will include further considerations, so are not limited to the immediate conclusions drawn from the case studies.

The first requirement is the combination of recognizable indeterminacy and adequate heterogeneity (among participants). This is a central requirement when deliberation is the main goal, or an additional feature when a product such as a risk framework or capacity building is to be achieved. As soon as spaces are designed, rather than emerging (which was Dewey's starting point in developing

his thought on reflective inquiry as we saw in Chapter 2), a set of rules is provided which both enables and constrains interaction. These rules should include provisions for divergence from them when they turn out to be too constraining. Of course, while the set of rules that is provided can draw on general rules and experiences accumulated over time, the actual set must be specific to the situation.

Second, in spaces for assembly there is always some orchestration of interactions, for example by a moderator, through external input, or because of the division of work within project teams. Orchestration can be directed towards achieving a concrete goal, or be more open-ended while remaining within the bounds of the aim to stimulate public-sphere type interactions. External input in the form of sociotechnical scenarios appears to be a good way to raise awareness of actors about how they are embedded in broader multilevel, multi-actor dynamics.

Third, while the actual structuring of the space and the orchestration of the processes in the space are important for specifying a good space, just as important is the external condition that participants have, or may realize they have, a common concern. This means that their coming together is not merely because they happened to be invited, but can count as 'assembly' in Dewey's sense, that is, those who are implied in the indeterminate situation assemble because there is something at stake for them. The common concerns can be articulated in interaction, either at the beginning of the exercise or before, for example by a CTA analyst interviewing potential participants and creating a diagnosis of the indeterminate situation. The concrete stakes of the different participants need not be the same to realize public-sphere type interaction. Actually, the friction and tension that can occur precisely because the stakes are different, stimulate articulation processes through which, in principle, better – that is more encompassing, more reflexive – decisions can be made.

Fourth, it is not sufficient to focus solely on creating perfectly orchestrated interaction events. The cases showed that the established roles, responsibilities and mandates of actors at the collective level influence actual interactions and constrain the subsequent uptake of issues and considerations in decision-making processes and agenda setting. However, roles and regimes are not fixed and can adapt to changing circumstances. In the space for assembly, this can be tried out (cf. Dewey's notion of 'rehearsal' as part of reflective inquiry). One implication is that the organizer of the space must map and make visible current dynamics as a starting point for interaction and reflection. This is an empirical-analytical challenge in its own right (see Parandian 2012 for examples of how to do this).

Fifth, the challenge of having more reflexive societal learning and articulation processes in relation to NEST and its emerging societal issues does not concern how we might have more involvement of civil society actors, but rather how their involvement can improve the discovery and articulation of emerging societal issues occasioned by the development of NEST. As argued in Chapters 1 and 2, the challenge is to overcome the division of moral labour between nanotechnology developers and civil society actors, visible in upstream engagement activities, and create spaces where technology developers inquire into and articulate emerging societal issues, while civil society actors (such as civil society organizations) inquire into and reflect on how actual development trajectories challenge, contradict or contribute to their stakes, needs and dilemmas.

Competences need to be developed on both sides if we are to have these types of interactions. Civil society actors should develop the capacity to articulate sociotechnical critique: to appreciate new technological options and their embedding in society, not necessarily to criticize them as wrong or misdirected, but to explore, anticipate and assess them (cf. Chapter 6). Interaction with civil society actors can be organized in the form of promise-requirement cycles, which are part of innovation trajectories. The promise relates to immediate and longer term (diffuse) values and desired prospects (cf. Chapter 2). It offers an entrance point for civil society actors to become involved in innovation trajectories and articulate sociotechnical critique, up to the co-construction of projects (see for example also the co-construction of field trials for GM vines in the Alsace, mentioned in Chapter 3). Developers of newly emerging science and technology and other actors such as governments have to develop competences to engage in dialogue. These include a willingness as well as a capacity to accept discussion of innovation trajectories and promise-requirements cycles rather than seeing them as given ('take it or leave it'). Helpful in this respect is the development and discussion of fictive scripts (see Chapter 2 and Den Boer et al. 2009) as such, and as a way to allow input from civil society actors.

Sixth, affordances should be present at the collective level of societal agenda-building and institutional regimes to make it easier for developers and promoters of NEST, as well as other stakeholders and civil society actors, to assemble and deliberate about NEST and its emerging societal issues. While at the moment the anticipation and taking into account of emerging societal issues is not part of institutional mandates and responsibilities of developers of NEST, this may change. The European Commission, through the DG Research, Innovation & Science, has been actively pushing for new responsibilities, for example with its proposed Code of Conduct for Nanoscience and Nanotechnologies Research and the new policy discourse on Responsible Research

and Innovation (RRI). RRI will be an integral part of the next Framework Programme, Horizon 2020. In the healthcare context, funding agencies such as ZonMw in the Netherlands and the National Institutes of Health (NIH) in the US now actively push researchers and clinicians to involve end users (that is patients and patient organizations) as new dialogue partners in decision-making processes with regard to translating fundamental research into the development of new drugs, treatments or methods of prevention (cf. call for translational research).[118] The rationale behind the push for translational research is to improve its effectiveness, that is, to be able to deliver more and quicker results (for example for new drugs or treatments) from investment in medical research. Here, there may be a conflict with having public-sphere type interactions because these are time consuming, require an explicit effort and may not produce univocal results that can simply be taken up. However, what we do see is that the call for translational research creates affordances to develop spaces where researchers, clinicians and civil society actors can assemble to have NEST as a topic for deliberation.

The present mandates, self-styled or projected, of civil society organizations do not necessarily include public-sphere type interactions about NEST, at least not in the sense of taking part in dedicated spaces for assembly (see Chapter 4). One argument for such a position is that there should be asymmetry in responsibilities: civil society organizations need not be co-responsible for the novelties brought into the world by developers of newly emerging science and technology. As discussed in Chapter 1, developers of newly emerging sciences and technologies can refer to an existing division of moral labour, while others have to be concerned with what happens with the technology in society. However, with the new affordances, it becomes less legitimate to do so: if scientists and industrialists bring novelties into the world, they can be held to account by others, who can now refer to the EU Code of Conduct.

[118] The NIH articulates the challenge of translational research in the following manner (quoted after Maienschein et al., 2008, p. 44): '(…) the exciting discoveries we are currently making require us to conduct even more efficiently the complex clinical studies needed to make rapid medical progress, and to further inform our basic science efforts (…) We must develop strong new partnerships among laboratory researchers, clinical researchers, clinicians, community clinics, those developing medical delivery systems (e.g., drugs, devices), and clinical research networks; moreover, we must fully involve and empower the public in the research process'. For more information on the call for translational research by the NIH, see <http://commonfund.nih.gov/clinicalresearch/overview-translational.aspx>. For more information on the call for translation research by ZonMw see www.zonmw.nl/nl/themas/thema-detail/translationeel-onderzoek/programma-detail/ (last visited 28 January 2013).

The implication for spaces for assembly at present is that they should be seen as a locus where articulation processes about roles and mandates can be started with the help of concrete cases of concern. Only at a later stage can they become a regular way of handling NEST in our society. Such articulation processes are not limited to the protected spaces that have been studied and discussed in previous chapters. For example, activities of CSOs such as protest, web-based petitions and occasional direct action, lead to responses and positioning, not just in terms of what should or should not be done, but also about the legitimacy of CSOs and their own actions. Friction and tension can lead to articulation processes, both on a small and large scale (see also Rip 1986 on controversies).

These six clusters of requirements do not always offer specific prescriptions, and actually should not do so, in order to leave room for actors' initiatives and emerging interactions. What they offer is a list of considerations and a discussion of the conditions that are important when designing good spaces. They also reflect the multilevel character of the challenges, when moving from the set up and orchestration of spaces for assembly to their functioning in specific contexts, and then to the dynamics of the contexts themselves and the implications for spaces of assembly.

Section 7.2 Emerging extension of the public sphere?

Productive interactions in actual spaces are important, but just as important for the overall challenge of handling NEST are the affordances and external conditions that allow, or pressure, developers of new technology, civil society actors and other stakeholders such as government agencies to consider NEST and its emerging societal issues as a topic for extended deliberation and negotiation. These affordances and external conditions may well be part of an ongoing wider development, an extension of the public sphere that addresses NEST. This section will consider the challenges that have to be addressed to make such an extended public sphere work and will discuss which affordances and incentives are currently available to contribute to such an extension of the public sphere.

A key challenge for an extension of the public sphere that includes deliberation about NEST is the distance of NEST from daily concerns and discussion. First, NEST is indeterminate: promises are voiced, but nobody knows how the technology will become embedded in society. This implies that the content for deliberation is not immediately clear. Second, there is the issue of time: NEST is a promise for the future. People are not yet experiencing concrete dilemmas or concerns in their daily

lives occasioned by emerging science and technology developments. As a consequence, people may not yet be motivated to participate in the public sphere. In any case, for NEST to be a topic of deliberation, anticipation and imagination will be required (see Chapter 2). Both challenges have come up in my discussion of interaction within spaces, but here I will discuss them as challenges for the non-local metatopical common space of the public sphere. Recalling the approach by Taylor (2002) presented in Chapter 1, the public sphere is a locus of discussion that potentially engages everyone. It is a common space in which members of society, who are concerned or affected by particular societal developments, understand themselves to be in discussion about matters of common concern, and who can interact indirectly through a variety of media. The media infrastructure enables as well as shapes and constrains interactions characteristic of the public sphere (Taylor, 2002).

Taking the theoretical reflections from Chapters 1 and 2 and the empirical findings from Chapters 3 to 6 into account, how might an extended public sphere in which NEST is addressed be delineated? First, as already mentioned in Section 7.1, to have NEST as a topic for societal deliberation and negotiation, all actors should develop competences. Actors with institutionalized roles and mandates to develop and embed NEST should develop competences with respect to dialogue, including the willingness as well as the capacity to accept discussion about the desirability and usefulness of particular technology trajectories and product developments. Civil society actors should develop the capacity to articulate sociotechnical critique (cf. the discussion in Chapter 6, Section 6.4).

Second, as was shown in the case studies, in our society special efforts are required to aggregate, share and otherwise disseminate what is occurring in the protected spaces for interaction so that insights arising there can become part of the public sphere. The necessity of such efforts is not mentioned by Dewey and Arendt. Both assume (and this is particularly apparent with Arendt) that as soon as issues are articulated they become part of a public discourse and people can act upon them.

Third, an extension of the public sphere that addresses NEST would imply that developers and promoters of nanotechnology and civil society actors should understand themselves to be involved in a matter of common concern, although with different roles and responsibilities, and that they are willing to engage in conversation about this, although perhaps only indirectly through media. This also implies that spaces for interaction have to be present in society, such as various media and science cafes where indeterminate situations occasioned by NEST can be a topic for deliberation between these different types of actors. However, that there is a matter of concern does not imply

that it has already been articulated and shared. What the common concern might be has first to be found out. One route is that NEST and various promise-requirement cycles are a topic for deliberation in various media (newspapers, magazines, social media) and in meetings (be they public or restricted). Another route is that 'third persons', such as CTA analysts (Chapter 6) or a Committee that is appointed (Chapter 5), articulate common concerns. These actors then fulfil the role of Deweyan 'officials' and organize spaces for reflexive inquiry. It is conceivable that third persons become an integral part of innovation trajectories and their governance, and a new role emerges where third persons professionalize and offer their service in articulating indeterminacies and organizing actual spaces for interaction. One already sees mediators in the public sphere, such as analysts, Committees, science communicators, Technology Assessment Institutes and journalists, who articulate issues and assemble those who are interested and concerned.

Thus, a key difference between the traditional public sphere and one in which NEST is a topic for deliberation is that emerging societal issues occasioned by NEST are not immediately accessible to all actors, and that special efforts are necessary, not only in terms of competence building, as noted above, but also in ensuring that different types of actors have the opportunity to share their visions, claims and expectations and hear those of others. In this way, societal agenda-building processes can take place, which lead to the articulation of problematic issues that all actors have to take into account even if they do not share the same perspective on them. These are the same sorts of steps followed in Deweyan reflective inquiry, but now with only occasional face-to-face interaction.

Because newly emerging sciences and technologies are still under construction, lived experience, which both Dewey and Arendt focus on, cannot be the sole source of NEST becoming a topic for deliberation in the public sphere. External input is needed to provide information about what is occurring in different worlds (for example in laboratories, start-up firms, and worlds of civil society actors). This allows people to be able to develop opinions and perspectives in relation to NEST and articulate emerging societal issues that lead to productive deliberation and negotiation about the development and governance of NEST. Sociotechnical scenarios offer a way of conveying the complexities associated with specific developments and their embedding in society, which is necessary to overcome the limitations of communication as transmission.

These are the principle (but empirically informed) considerations with regard to an extended public sphere which addresses NEST. What is happening at present? We can now usefully return to items

already discussed in Chapter 1 and 2. There are hopeful developments, particularly concerning nanotechnology. I will briefly discuss those which are the most important.

First, there is already a cultural repertoire available to discuss NEST and identify future directions. A repertoire enables and constrains deliberations. As argued in Chapter 2, it is now relatively easy to discuss the promises and risks of newly emerging science and technology because a cultural repertoire is in place. Moreover, it is not just a matter of discourse, there are also institutions that conduct studies into health and safety issues occasioned by the development of nanotechnology, and it is expected that these studies will be done in relation to other newly emerging sciences and technologies. Nevertheless, although the current cultural repertoire addresses important items, the focus on promises and risks is limited. At the same time, there are initiatives to expand the discussion and thus extend the cultural repertoire. Interestingly, focus groups, as conducted in the DEEPEN project (McNaghten & Guivant, 2011) and in Norway (Throne-Holst, 2012) (cf. Chapter 5), have shown how groups of citizens dip into existing repertoires and create narratives about NEST which resonate with others and may spread through discussions, both locally and through various media. A different route to extending the existing cultural repertoire is being created by ELSA studies. In addition to studies of SHE (Safety, Health and Environmental) issues, since the 1990s there have also been studies into broader ethical, legal and societal aspects (ELSA) (for more information on ELSA, see footnote 9 in Chapter 1). These studies are primarily conducted by social scientists and philosophers, and one aim is to integrate the insights gained into the further development of the technology in question. However, the results of these studies can also become a resource for other actors to draw upon, and thus an input into further deliberation and negotiation.

Second, there are already organizations present in our society that have an institutional role and responsibility to stimulate societal deliberation in relation to new science and technology. In the Netherlands, there is the Rathenau Institute, whose mission it is to promote the articulation of political and public opinion about the societal impacts of science and technology developments by commissioning and distributing reports, writing blogspots and organizing debates and science festivals.[119] Other countries in Europe have had similar organizations, such as viWTA in Belgium and the Danish Board of Technology in Denmark, which now survive in a different format after their

[119] www.rathenau.nl.

direct state support ceased in 2012.[120] One can see this as an indication that they fulfil a societal function.

Thirdly, as Rask et al. (2012) observed, there are by now also CSOs, such as Vivagora and Fondation Sciences Citoyennes in France, that have been established with the purpose of empowering citizens and supporting deliberations on newly emerging science and technology via public debates, conferences and web-based petitions.[121]

Fourth, traditional media such as daily newspapers and television pay attention to new science and technology developments (Te Kulve, 2006). With the new media, such as blogspots and Twitter, civil society actors are now in the position to immediately express and share their opinions, visions and concerns. This links up with the challenge, as mentioned at the beginning of this section, that for NEST, the content for deliberation is not immediately clear. With these new forms of media, sociotechnical criticism can be voiced immediately, but these can also be driven by unverified stories and strong opinions,[122] and there is no way for scientists to control this. One may complain about this situation, but such freedom is exactly a feature of the public sphere.

It is not only the existing media and the emergence of new media and intermediary organizations that enable extended societal deliberation and negotiation in relation to NEST. The institutionalized roles and mandates of scientists and engineers developing new science and technology are also gradually changing. New science and technology developments used to be enacted in protected spaces, and 'society' was confronted with the results of these developments downstream. Recently (in fact, as early as the 1970s), there have been policy and societal pressures to open up the culturally protected space in which science and technology work. This opening up takes place in different ways.

[120] For viWTA see: www.samenlevingentechnologie.be/ists/nl/pers/viwtaindepers/viwta.html; for the Danish Board of Technology, see www.tekno.dk/subpage.php3?page=statisk/uk_profile.php3&toppic=aboutus&language=uk.

[121] www.vivagora.fr; http://sciencescitoyeness.org

[122] An extreme example is how the lobby against vaccination used the argument that the injection would also put nanorobots in recipients' bodies, which would enable the government to control people (see for example, www.wanttoknow.nl/overige/de-nano-chip-in-de-vaccinatie-naald/, or http://weblogs.nrc.nl/discussie/2009/11/11/wat-kan-de-overheid-doen-om-geruchtvorming-te-bestrijden/).

One development that can be witnessed is that actors with institutionalized roles and mandates to develop and embed newly emerging nanotechnology increasingly position themselves as willing to be transparent about the choices they make during the development of newly emerging nanotechnology. In this way, an opportunity is created for other actors, such as civil society actors, to become involved and raise questions (see for example Chapter 4, NanoCap). The promise of transparency is visible in Codes of Conduct. Some companies have formulated such Codes, for example the chemical companies Bayer and Degussa, but Codes of Conduct have also been developed at the collective level in branch organizations. There have also been initiatives involving different types of actors, such as the UK Nanotechnology Industry Association and the Royal Society, who attempted to develop a Responsible Nanocode.[123] In 2008, the European Commission developed a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research.[124] In our society, these Codes of Conduct are soft governance proposals, implying that companies and research institutions are not obliged to adopt the guidelines in daily practices, but can (and do) adopt them voluntarily.[125] Codes of Conduct are now visible and can be referred to in the public sphere. Concretely, interactions can be started when societal actors ask nanoscientists and other developers to account for what they are doing, referring to these Codes of Conduct to justify their request. In this way, nanotechnology developments become more transparent and a topic for deliberation in the public sphere.

Moreover, in some cases, these Codes also mention, be it tentatively, that nanotechnology could be a topic for societal deliberation and negotiation. See, for example, how the first and fourth guidelines of the EU Code of Conduct are formulated: 'nanosciences and nanotechnologies research activities should be comprehensible to the public (…)' and 'nano-research activities should (…) allow the

[123] See www.nanotechia.org/nia-activities/responsible-nano-code

[124] With this Code of Conduct, the European Commission proactively sets guidelines and principles for new responsibilities and mandates of universities and industry (and also representatives of civil society, as we saw in Chapter 4) involved in the development of nanoscience and technology. Guiding principles such as inclusiveness and accountability are used. The EU Code of Conduct demands different ways of defining research agendas and accountability than is normally the case in universities or industry. With regard to 'inclusiveness' the Code states: 'nano-research activities should be guided by the principles of openness to all stakeholders, and should allow the participation in decision-making processes of all stakeholders involved in or concerned by nano-research activities' (p. 6). With regard to 'accountability': 'researchers and research organizations should remain accountable for the social, environmental and human health impacts that their nanoscience and nanotechnology research may impose on present and future generations' (p. 7). Thus, new roles and responsibilities for developers of nanotechnology (and also CSOs) have been articulated by the European Commission.

[125] As Reichow and Dorbeck-Jung argue (2013) based on Senden (2004), soft regulation refers to rules of conduct which do not have a legally binding force, but which nevertheless can have regulatory force in regulatory practice.

participation in decision-making processes of all stakeholders involved in or concerned by nano-research activities'. Thus, an extension of the public sphere is envisaged.

In addition, industrial actors increasingly position their R&D work as contributing to addressing societal challenges and needs, often referring to Corporate Social Responsibility (CSR). With this move, traditional boundaries between the private and public spheres become blurred. Companies, such as the multinationals DSM and Evonik, are not exclusively focused on only realizing their private aims, such as making a profit, but also position themselves as being responsive to societal challenges, needs and concerns, at least in principle. Such CSR activities may be symbolic exercises that do not go beyond open-house events or employees conducting volunteer work. However, because companies now publicly commit themselves, for example via position papers, to addressing societal needs and concerns, they can be approached and held accountable by other actors who refer to Corporate Social Responsibility.

What can be further observed is that knowledge production and science are opening up to further inputs (that is, from patient organizations, citizen science, indigenous communities), which implies not only opportunities for lay people to interact with science, but also some deprofessionalization of knowledge production.[126]

A recent and potentially important policy development is the move to Responsible Research and Innovation (RRI) that is visible in Europe, also in the preparations for Horizon 2020, the upcoming new EU Framework Programme for Research and Innovation. As EU policy officer Von Schomberg (2013) stipulates, RRI should be seen as a strategy adopted by actors from industry, research and civil society 'to become mutually responsive to each other (…) and to the "grand challenges" of our time for which they share responsibility (…) and to which research and innovation processes should become more responsive and adaptive' (Von Schomberg 2013, p. 1). Von Schomberg continues by arguing that RRI 'should be materialized in terms of the research and innovation process as well as in terms of (product) outcomes' (p. 24). The advantage, according to Von Schomberg, is that actors 'cannot exclusively focus on particular aspects (for instance civil society organizations addressing only the risk aspects) but have to take a position on all aspects of the innovation process as such' (p. 24). RRI is still an open proposition, and how this will take shape, and what the most productive division of labour will be, is something that must be worked out and experimented with. As Fisher and Rip

[126] See MASIS report on recontextualization(Mejlgaard & et al., 2012) , also ESF workshop report Vienna, May 2012.

(2013) point out, there are some directions/foci of debate visible in developing RRI, such as the emphasis on transparency (for developers of new science and technology), upstream public engagement and the predominant focus on risk issues (rather than broader societal issues). These foci could create a lock-in situation. It is thus necessary to subject such trends to critical evaluation.

In indeterminate situations, there is always a tension between exploring issues further and choosing to take action with the aim of making a difference. Being confronted with indeterminacy, it is more intelligent to not act immediately or develop proposals for implementation,[127] but to further inquire into foundational issues as a way to uncover more details, more problematic issues, upon which better informed choices and strategies can be formulated.

Considering broader developments in the wider world – which occur anyway, independently of what happens in dedicated spaces and the processes of aggregation – one sees a patchwork of ongoing attempts to have NEST and its emerging societal issues as a topic for deliberation and negotiation. This also creates pressure on actors: if one does not want to engage in such societal articulation processes, one has to give a reason. Such argumentation itself then becomes part of articulation processes. In this way, NEST increasingly becomes a matter of concern for all.

Thus, I can claim that an extended public sphere that includes NEST is emerging. Will this make a difference by allowing better, more informed and more encompassing decisions? This is not just a matter of the quality of the deliberations, but also depends on existing roles, responsibilities and mandates of actors, and whether these are opened up to take the new inputs into account. This is linked to larger questions concerning the *de facto* constitution of our late-modern, technology-imbued societies. The traditional public sphere is integral to the functioning of parliamentary, democratic decision-making. The extended public sphere, including NEST, with its emphasis on interaction between developers of technology and civil society, can support parliamentary democracy, but is actually closer to neo-corporatism, with its emphasis on the legitimacy of horizontal deliberation between relevant parties or stakeholders. This is not a plea for neo-corporatism, but it is way of capturing a development that is already occurring: neo-corporatist arrangements structure the way in which NEST is developed and governed in our society. Such

[127] Promoters of new science and technology often push for action because of the expected benefits, which should be realized as quickly as possible. This argument was emphasized in the debate around genetic modification in the 1970s and early 1980s ('Each day that is lost implies that people will die unnecessarily'). To which Hans Jonas famously replied, 'It's no sin to delay a benefit' (Jonas, 1985).

existing arrangements can be a constraint on how the extended public sphere which includes NEST can contribute (cf. my discussion of the present division of moral labour that must be opened up). For this reason, Fisher& Rip (2013), in their analysis of the present move towards RRI as a move towards neo-corporatism, argue that it should be reflexive neo-corporatism. The arrangements must be open to deliberation and negotiation, not just by the inclusion of actors other than those that traditionally have mandates and responsibilities to develop and embed NEST, but also to articulate, in concrete cases, for whom something is at stake and which neo-corporatist arrangement will best serve the purpose.

Section 7.3 The thrust of the thesis

By situating and analysing spaces for assembly where NEST is a topic for deliberation in a broader multilevel context, and focusing on public-sphere type interactions as determinants of good spaces, I was able to offer conclusions concerning the design of such spaces (Section 7.1), as well consider the background issue of an extension of the public sphere (Section 7.2). The extended public sphere is important for the viability of good spaces for assembly, and also emerges because of the experiences with such spaces for assembly. The normative thrust here concerns the importance of substantial public engagement (rather than participation for participation's sake) and how this should include Deweyan reflective inquiry and Arendtian activity of action. It is against this vision of what should be the case that the limitations of the present situation can be identified and ways to overcome them discussed. This final section of the thesis summarizes this thrust, but also recognizes the bias involved: more public engagement is assumed to be something good in its own right. To create a balance, I briefly consider possible reasons for non-engagement.

Generally, realizing more interaction with and participation by civil society actors is considered important, and efforts are being made (and resources are available) to organize actual participation events. The emphasis is on information and consultation, which in the literature on deliberative democracy (see for example Brown, 2009; Callon et al. 2009) is criticized as being too limited. I have added deliberation about matters of common concern in relation to newly emerging science and technology. Such deliberations take place in spaces for assembly and include negotiation – because there are a variety of perspectives, positions and interests – as well as aggregation towards outcomes that can become visible elsewhere and contribute to the extension of a cultural repertoire that can be drawn on when making choices and decisions. Thus, such deliberative interaction events

are sites for the functioning of the public sphere in society. For newly emerging science and technology there are challenges because of their open-ended character, the distance of civil society actors to ongoing scientific and technological developments and the fact that the important and eventual decision contexts are not regular democratic organs but, broadly speaking, daily work environments of actors involved in research and innovation trajectories. The current initiatives to involve civil society actors during the early stages of the development of newly emerging nanotechnology are important as such, even when these emanate from a wish to prevent a public backlash, as is considered to have happened with biotechnology. The current initiatives to involve civil society actors also offer opportunities to learn about how to deliberate on newly emerging science and technology. Such learning can build on the identification of limitations in current activities, as well as explore interesting possibilities to do better; for example, as I have done through tracing public-sphere type interactions.

In phrasing it this way, it is clear that there is a basic presumption that more and better deliberation about newly emerging science and technology is important. In conclusion, I will briefly discuss this presumption; also by drawing attention to its counterpart, the right not to engage in deliberation.

Why more engagement in deliberation? With upstream public engagement, the funding of ELSA studies and the organization of spaces for assembly there are initiatives and incentives in our society to develop NEST and its promises and simultaneously anticipate societal issues and concerns so that these can be accommodated in research and innovation trajectories. However, realizing the promises and benefits of nanotechnology, on the one hand, and addressing and/or studying emerging societal issues and concerns on the other, are still two more or less separate trajectories that co-exist with only occasional alignment and integration. It is relatively easy for the actors involved to put aside societal issues and continue with realizing promises, because anticipating and taking into account societal issues is not part of their (institutionalized) tasks and mandates. There is a need to do better in aligning science and technology developments with societal needs and issues, and to make more reflexive (more informed, more encompassing) decisions in the present. The way to pursue this goal is to have more productive interaction between developers and promoters of new science and technology and civil society, and spaces for deliberation are important for this to occur.

There is a further consideration: as Dewey and Arendt argued, and as I have taken up to some extent, if public-sphere type interactions do not accompany technology developments, then civil society is reduced to a passive receiver, or, in the words of Arendt ‘helpless slaves’, ‘at the mercy of every

gadget which is technologically possible' (Arendt, 1998). Novelties are introduced and people are confronted with them, without there being any technology appraisal other than from the perspective of developers and promoters. Rather than this passive reception there should be activity of action – but this is not easy. As Arendt reminds her readers time and again, acting in the public sphere requires courage because it implies interaction and participation in the light of the unknown. You do not know what you are unfolding in the public sphere because others also act and it is not possible to foresee if and how your concerns, stakes and values will be taken up by others. Interaction in the public sphere thus implies putting yourself at risk. Dewey does not consider this existential risk, but does address the importance of reflexive inquiry in our society.

Having different types of actors involved in technology appraisal is now taken up in the well-known argument for the participation of users, and of civil society actors more generally. Inspired by Dewey, I have linked the productive involvement of civil society actors with the need to address indeterminacies rather than merely involving civil society actors as new dialogue partners because they represent 'societal issues and needs'. The challenge is thus not to have more civil society actors involved in research and innovation trajectories, but how their involvement can improve the identification and articulation of emerging societal issues occasioned by the development of NEST. Who should be involved and what types of interaction are productive both depend on the diagnosis of indeterminacy, and remain part of what has to be found out and articulated.[128] Outreach, accessing as many citizens as possible, does have some value, but should not replace the inquiry into indeterminacy. My insistence on addressing indeterminacy and considering articulation processes rather than immediate negotiation about the decisions to take has implications for who is to engage or be engaged, and how. One point is the need to inquire into indeterminacies and those who might be affected, and how this requires more than focus groups and other opinion articulation exercises. Empirically informed sociotechnical analysis, imagination and anticipation are necessary, and third persons play a role here (cf. Lindblom 1990).

Moreover, in our society there are professional spokespersons and official representatives for particular issues, such as dedicated NGOs, but also CSOs who are seen as representatives of 'societal

[128] This implies that not just any scientist, or, for that matter, any individual citizen or CSO has to participate. A simple example is how scientists operating in the domain of nano-electronics will not have to participate in the extended public sphere because no indeterminacies exist in their domain, while scientists operating in the domain of nano-enabled drug delivery, or nanotechnology and food have the responsibility to participate in the extended public sphere. Of course, the situation is more complex, and is evolving, but it illustrates my point that the need to engage differs.

needs and issues'. They can play a role in deliberation, but having NGOs or CSOs as dialogue partners should not mean that the search for those who are affected comes to an end. It is easy to invite dedicated NGOs and CSOs to interaction events because of their visibility and their standing on particular issues. This is, as it were, engagement-supply push. My argument is that issue pull, as part of inquiry into indeterminacies, must be the starting point (see also Marres 2005, 2007). This might well identify certain NGOs and civil society organizations as relevant participants in the space for assembly that is emerging and/or being organized,[129] but it also implies that those who are or might be affected might not be immediately visible and must be discovered and articulated.[130]

Another side to this coin, however, is the reluctance of institutionalized spokespersons to commit themselves to participate in deliberation because they will be seen as co-responsible for the outcomes even in cases where their interests or perspective is not fully taken into account (this also occurs with actors who have institutionalized roles and mandates to develop and/or embed NEST). This is a well-known quandary, for example in interactions between trade unions and corporate management. It is also visible in what could be called the tactics of engagement, such as when participants necessary for the legitimacy of the interaction event threaten to leave (and sometimes do) so that the event can be criticized as lacking legitimacy.[131]

There are broader issues involved than the tactics of engagement. Speaking with Arendt in mind, there may be a reluctance to put yourself at risk in the public sphere, despite it being necessary to do so, as Arendt argues, and thus participate in the *agora* (Chapter 2.3). In saying this, she neglects another Greek concept of *idiotès*: people who consciously choose not to participate in the public sphere withdraw from the *agora* and exclusively concern themselves with their own private affairs (cf. Lezaun and Soneryd, 2006). In the deliberation about NEST, the equivalent is limiting yourself to your own mandate and legitimate interests and not engaging in public-sphere type interactions. Neither civil society actors nor industry, or scientists for that matter, necessarily have to follow the

[129] This also raises the difficult question of who decides who the relevant participants are. In practice, it is often the initiator of the interaction event. If s/he engages in a preliminary inquiry, it might be argued that this is a productive way (see 7.1 about the preparation of CTA workshops). This shows how reflective inquiry is also reflexive, in the sense that it considers its own process (cf. earlier point in 7.1, about rules that should include the breaking of rules).

[130] As already argued in Chapter 2, the development and societal embedding of nanotechnology is a global challenge that transcends national boundaries. This implies that those who might become affected by the consequences of nanotechnology, or 'those who are concerned' cannot solely be found within a national border, or in Western Europe.

[131] This occurs, for example, in the Dutch Societal Dialogue on Food and Genes (see Chapter 5).

ambition of the European Commission to create Responsible Research and Innovation and have NEST as a topic for societal deliberation and negotiation. They could be modern day *idiotès*. However, what are private affairs? The development of NEST has world-shaping effects: NEST contributes to the realization of particular futures in which certain societal values, norms and responsibilities may become dominant, while others are backgrounded, silenced or remain underdeveloped. These are public affairs, matters of common concern. Developers and promoters of NEST, those who currently have the agency to steer and make decisions, contribute to the shaping of the world (as other actors do) and cannot simply withdraw on the basis of a limited mandate. Actually, what determines whether an issue is public or a private is in flux because of NEST and its indeterminacies. Science and industry involved in NEST do take part in the public sphere. Transparency is pursued, but within limits, for example through confidentiality of competitive information. Risk governance is no longer the exclusive business of experts but includes the involvement of those affected and their spokespersons. With the governance incentives for upstream public engagement and RRI, there is a demand for civil society engagers. Civil society actors are thus faced with the question of whether 'to engage or not engage?' They have a right not to engage, but the question of what that right is and when it is applicable has to be addressed.

It will be clear that my analysis of spaces for assembly and deliberation about NEST, with the focus on the productive involvement of civil society actors in the development of NEST and its embedding in society, touches on foundational issues. I have focused here on engagement, but this cannot carry the whole weight of the challenges we will face. In closing, I note the multilevel point that direct interactions between actors have to be productive, but existing institutions and their mandates/responsibilities to develop and embed newly emerging science and technology have to evolve as well to allow inquiry and deliberation among different relevant actors. In fact, independent of how they afford deliberation and the accommodation of its outcomes, there is a challenge for institutions and institutional arrangements to do justice to the dynamic and indeterminate character of NEST. They should have a measure of flexibility so as to be able to respond to changes and accept tentative approaches, rather than strict arrangements. The ongoing effort to create upstream engagement and the possibility of Responsible Research and Innovation then become opportunities to shape our social order more reflexively.

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List of acronyms

CSO	Civil Society Organization
CSR	Corporate Social Responsibility
CTA	Constructive Technology Assessment
EDF	Environmental Defense Fund
EC	European Commission
ELSA	Ethical, Legal, Social Aspects
ELSI	Ethical, Legal, Social Issues
EU	European Union
NEST	Newly emerging science and technology
NGO	Non-Governmental Organization
RRI	Responsible Research and Innovation
R&D	Research & Development
TA	Technology Assessment

Appendix 1 Intervention used in CTA+ workshop 1 and 2

For workshop 1 and 2, I developed an intervention to stimulate discussion in the second round. We used a white board and yellow notes. Participants had to describe during the break, after hearing the issues that were brought up in the first round, how they viewed their own responsibilities and the responsibilities of other actors within the development and societal embedding of point-of-care devices (see graph below that was developed for workshop 1 and 2). The assumption behind this intervention was twofold. First, as organizers, we thought that it would stimulate reflection on the indeterminate situation because participants were explicitly asked to ' stop and think' about role and responsibilities in relation to the issues that were explored and articulated in phase 1. Second, the assumption was that by writing roles and responsibilities down, this would help the discussion in phase 2. By making it visible (see graph) we thought that the participants could easily identify issues that were in need of settlement (and thus in need of rehearsal) for example because there were ' deserted issues', that is, issues that were articulated in phase 1 and that nobody feels responsible for.

Position in innovation (chain)	Own responsibility	Responsibility of other actors
Funder + comparative selector: insurance company		
Developer of lithiumchip		
User: Patient		
User: Psychiater…		
Etc.		

For workshop 3, we chose a slightly different orchestration format. When workshop 1 and 2 were finished, we concluded that the intervention did not contribute much the discussion in phase 2 and 3. It served as a way for the moderator to summarize the discussion and to suggest a way forward after the break, but overall, the intervention led to confusion by the participants. They asked me and the moderator repeatedly: 'what do you except?' 'what is your goal with writing responsibilities down?'

For workshop 3, we chose to stimulate the development and rehearsal of new or adapted values, norms and responsibilities only through moderation. Also in the preparation document and at the start of the workshop, we emphasized these phases explicitly.

Appendix 2 Follow up interview questions

1) What did you think of the discussion? Were challenges or issues identified that play a role in your organisation, now or in the future?

2) How do you perceive your own contribution to the workshop? Was it primarily speaking or listening what you did? Did you choose this role or were you forced to do so?

3) The participants in the workshop came from different positions with regard to the development of the new technologies and had different perspectives. How do you consider the contributions of the other participants? Did you hear new things? Did your views changed or became more nuanced?

4) Prior to the workshop you received a scenario. It was meant to stimulate imagination of future developments in which dilemmas and challenges become visible and can be discussed. What is your assessment?

5) General question: What did the workshop deliver for you?

Summary

Newly emerging nanotechnologies, based on the observation and manipulation of matter on the nanoscale, are a challenge for society. All sorts of promises are being made, for example about better food or cheaper healthcare, but there are also concerns, including the risks that nanomaterials might pose to human health and the environment. At the same time, it is uncertain what forms the technology will take and how it will materialize in society. This PhD thesis investigates how civil society actors, both individual citizens and non-governmental organizations (NGOs), can be productively involved as new dialogue partners in the development and societal embedding of nanotechnology.

The development of nanotechnology is surrounded by attempts at anticipatory governance. Rather than waiting for societal impacts to become evident, government agencies and some technology developers now try to anticipate potential concerns and needs, with the aim of making better informed decisions about the further development of nanotechnology in the present. The early, or upstream, involvement of civil society actors as new dialogue partners is one of the forms anticipatory governance has taken. Civil society actors are now expected to become involved and, in cooperation with industrialists, scientists and policymakers, contribute to the responsible development of nanotechnology, addressing societal concerns, wishes and needs at an early stage.

Early involvement of civil society actors, in principle, provides opportunities to gain a better understanding of what nanotechnology might mean, since these actors can introduce new perspectives, experiences and dilemmas. However, how best to deliberate on newly emerging nanotechnology with civil society actors as new dialogue partners is not yet clear. This is a new situation for all of the actors involved, and there are no routines or established best practices that actors can fall back on. This PhD thesis takes up this challenge by studying what actually happens in spaces for interaction with civil society actors as new dialogue partners and analyses how this can be improved.

The starting point for the development of research questions and a research design and methodology is the diagnosis that in the design and orchestration of upstream public engagement activities the open-ended character of newly emerging science and technology, that is the combination of promises and uncertainty about actual outcomes, is insufficiently taken into account. This thesis examines four promising spaces where the development and societal embedding of

nanotechnology could be a topic for deliberation between nanotechnology developers and civil society actors. Based on this empirical study, combined with insights from the political philosophies of Dewey and Arendt, this thesis intends to develop requirements for how to design good spaces that allow for more productive interactions on nanotechnology. The design requirements will not only cover concrete spaces for interaction, but also address the broader context of which these spaces for interaction are part, such as the different organizations in which the various actors work and the institutions of science and technology in our society.

In current interaction initiatives between technology developers and civil society actors, the emphasis is primarily on providing information. Here technology developers are expected to provide factual knowledge on nanotechnology, and civil society actors are expected to recognize and put forward societal issues, needs and concerns. Developers of nanotechnology may listen and eventually decide to consider these issues in their decision-making processes or not. Such a division of labour simplifies and underestimates the socio-technical complexity. It assumes that nanotechnology, as well as the societal impact, are already given, while in fact, in the early stages, newly emerging science and technology and its consequences are still indeterminate. Promises are made, but nobody really knows what forms the technology will take, how it will materialize in society and what the societal impact might be. This implies that in the early stages societal issues are not just 'out there' and recognizable by civil society actors, but co-evolve with new development trajectories, and therefore have to be discovered and articulated.

The kind of societal issues that emerge depends on the considerations, decisions and actions of scientists, industrialists and policymakers. For example the choices made by government agencies or funding agencies with regard to sponsoring certain science and technology developments influence which promises can be further developed by scientists in R&D laboratories. The activities of scientists or industrialists – for example, to develop certain functionalities in medical devices – influence the actions of users. In general, the activities of different groups of actors are entangled one way or another. Together, they add up to emerging patterns of how a new technology can materialize in society and what the societal impacts might be. To gain insight in what newly emerging technologies might mean is then, ideally, a joint effort of all actors involved.

In order to anticipate more productively on newly emerging nanotechnology and its emerging societal issues requires that the traditional division of labour between nanotechnology developers and civil society actors visible in upstream engagement activities is overcome to a certain extent. Also

scientists, industrialists, and government agencies should share and discuss their activities and considerations, so that in interaction, and in relation to concrete circumstances, problematic issues can be discovered and articulated. Creating such interactions requires new or adapted roles and responsibilities for all of the actors involved.

An active public sphere, I argue, is a background requirement to more productive interaction between technology developers and civil society actors. A public sphere, the open space in society, is supported through a diffuse infrastructure that enables people to engage in extended deliberation (reaching across space and time) through a variety of media, such as newspapers and television, and recently also Twitter and Blogspots. The public sphere provides the opportunity to discuss and inquire into issues that relate to coexistence. A vital public sphere offers an opportunity for continuous inquiry into what is happening in society, and a space in which articulation processes occur concerning what is at stake and for whom.

This ideal of discussing newly emerging technologies as a matter of common concern in the public sphere is not easy to realize. A major part of society is not aware of new technology developments, and the products do not yet play a major role in daily lives. Therefore, there are very few, if any, lived experiences that people can draw on in interactions. Moreover, what forms the technology will take, how it will materialize in society and what the societal impacts might be remain uncertain. In fact, the dimensions by which new technologies can be assessed are indeterminate. Thus, for newly emerging technology to become a topic for societal deliberation additional efforts are required.

This thesis examines the challenges of having newly emerging science and technology (NEST) as a topic for deliberation in the public sphere, with civil society actors as new dialogue partners. This is studied in two complementary ways. Firstly, empirically, by studying spaces for interaction in which the actors experimented with a new division of labour, and secondly, by developing ideas about good spaces for interaction and their broader context, building upon the political philosophies of Dewey and Arendt, and then operationalizing the ideas in order to evaluate what happened in the empirical cases.

On the basis of this approach, the thesis addresses three research questions. Firstly, what kind of public-sphere type interactions would be most suitable for NEST as a topic for deliberation? Secondly, what could be good spaces that allow for these types of interactions? Thirdly, what are design requirements for creating and structuring such spaces?

Because it was not yet clear what would constitute a good space in which nanotechnology developers and civil society actors could engage in public-sphere type interactions, my aim was to cover a variety of spaces for interaction. In this way, insight could be gained into the different opportunities currently available for actors to assemble. These were evaluated not in terms of whether or not the objectives of the projects themselves were realized, but in terms of whether and how public-sphere type interactions could be realized, the type of interactions that are needed to gain insight into indeterminacy.

The first type of space for interaction can be seen in co-construction projects between industry and civil society organizations (CSOs). Whereas industrialists and CSOs traditionally operate quite separately in relation to the development of a new technology, over recent years several initiatives have been organized to co-construct products. Chapter 3 studies a three-year partnership between the chemical company DuPont and the environmental organization Environmental Defense Fund (EDF). These actors managed to co-construct a risk framework for the development, use and disposal of engineered nanoscale materials.

The second type of space for interaction is visible in capacity-building programmes for CSOs, funded by the European Commission. Currently, the European Commission provides resources for capacity-building programmes to allow CSOs to gain awareness of research activities (including nanotechnology) and build competences to take up their new role and responsibility as dialogue partner. Chapter 4 examines one such capacity-building project for CSOs called NanoCap. One main aim of the NanoCap project was to develop the capacities of environmental organizations and trade unions in order to enable them to participate in debates on nanotechnology at the national and European levels. Organizing interactions with nanotechnology developers was part of the project.

Since the 1980s, the organization of large-scale societal dialogues with citizens has been one way in which new technologies have become topics for public deliberation. What is new in this respect is that for nanotechnology such societal dialogues were organized at an early stage of its development, with its high degree of uncertainty, unpredictability and unknowns. Chapter 5 studies spaces for interaction that were part of the Dutch Societal Dialogue on Nanotechnology, which took place between 2009 and 2011. This Societal Dialogue was an attempt by the Dutch government to open up its policymaking process on newly emerging nanotechnology to bottom-up input from stakeholders and interested citizens, with the aim of identifying ethical and societal issues that were not being taken up by existing institutions. The actual design of the spaces for interaction was delegated to an

independent Committee, within boundaries specified in its mandate. The Committee itself was not a partner in the interactions, but enabled the setting up of a variety of local spaces for interaction by funding proposals for the organization of numerous activities in which stakeholders and citizens could learn about technology and share their views, values and dilemmas related to nanotechnology and its societal and ethical aspects. Chapter 5 also examines the goals, setup and outcomes of the Dialogue, ensuring that the multilevel structure of the Dutch Societal Dialogue is covered explicitly.

Chapter 6 presents CTA+ workshops organized by social scientists. These workshops were designed as microcosms (Parandian, 2012) in which groups of actors from separate but not independent worlds could meet and, in interaction, inquire into real-world indeterminate situations (macrocosm), in this case the introduction of nano-enabled devices to stimulate care-at-a-distance. As Rip & Robinson (2013) argue: 'what is new for nanotechnology, compared to previous emerging technologies, such as nuclear energy and biotechnology, is that now anticipation of societal impacts is seen as being also a responsibility of nanotechnology developers' (Rip & Robinson, 2013). Consequently, technology developers now perceive their participation in these types of workshops as legitimate.

What are the results of the empirical study? It is possible to organize good spaces for public-sphere type interaction. One of the requirements is the combination of recognizable indeterminacy (there has to be something 'at stake' for the participants) and adequate heterogeneity between participants, meaning that those who are involved in the indeterminate situation, albeit in different ways, are present. The collaboration between DuPont and EDF, as well as the creation of the NanoCap consortium, were occasioned by indeterminacies with regard to potential hazards and the governance of engineered nanoscale materials and engineered nanoparticles. However, while the occasion was similar, the CSOs involved positioned themselves differently in each case. EDF explicitly positioned itself as implicated in the indeterminate situation and as a dialogue partner with industry, with which it wished to jointly inquire into the indeterminacies. Environmental organizations that participated in NanoCap in contrast primarily positioned themselves as 'watch dogs' and claimed a position outside the innovation chain. They allocated responsibilities to technology developers and governments, but not – at least not explicitly – to themselves.

Indeterminate situations occasioned by the development of NEST are not always immediately apparent to those who are directly involved. Therefore, there is a role for intermediaries, such as science communicators and analysts. These types of actors can fulfil a role in articulating emerging

indeterminate situations and in organizing spaces that allow for inquiry into the indeterminate situation and the articulation of problems. These intermediaries have a different position within an innovation trajectory. They can move around in the different worlds and observe, ask questions and study what is happening, thus becoming aware of various issues, such as emerging patterns in the co-evolution of science, technology and society, that are more difficult to see for actors operating in a particular domain and focused on realizing their daily tasks and mandates.

The empirical study reveals that there is rapid recourse to, and focus on, risk issues, and consequently other societal issues, such as changing societal norms and values, remain in the background. In the co-construction project, as in the NanoCap project, participants explicitly stated that it was not their responsibility to inquire into broader societal issues. More than half of the projects that were part of the Societal Dialogue focused on discussing risk issues. This is not surprising given the fact that there is a cultural repertoire of types of responses to these issues on which actors can draw. Examples from earlier technologies can be mobilized and there are formal institutions that have mandates and responsibilities to study, for example, the toxicity of chemicals, including nanoparticles, and/or to inform citizens about health risks. For other societal issues, such as how technology shapes the way we relate to the world and to each other, there is much less of a repertoire available. Nevertheless, as part of the Societal Dialogue, projects were organized in which broader ethical and societal issues were a topic of inquiry. These projects showed that external input, such as scenarios and vignettes, were a good way to deliberate on these broader ethical and societal issues. The vignettes and scenarios presented a narrative of how possible actions, interactions and repercussions might play out and lead to particular societal practices in which some norms, values, roles and responsibilities can be more easily pursued than others. In an actual space for deliberation, these narratives can function as a platform for actors to inquire into and articulate problematic issues that must be taken into account (cf. Te Kulve, 2011).

The empirical study also showed that public-sphere type interactions between nanotechnology developers and civil society actors do not come naturally. Therefore, some orchestration of interaction is necessary. This can, for example, be done through external input, a moderator or by co-constructing a product. In the collaboration between DuPont and EDF, as well as in the NanoCap project, it was apparent that the necessity of creating a product stimulated the process of questioning between participants and the sharing of views and perspectives on what was at stake and what should be done. It also led to aggregation, because issues and stakes articulated during the project had to be considered in an outcome. In the CTA+ workshops, public-sphere type interactions,

formulated as a theoretical construct in Chapter 2, were stimulated in two ways. First, an empirically informed scenario was provided to the participants to add substance to the interactions, and second, a moderator stimulated interactivity using an interaction protocol. External input in the form of these scenarios appeared to be a good way to raise the awareness of actors about how they were embedded in emerging indeterminate situations and what was at stake for them.

While productive interactions in actual spaces are important, just as important for the overall challenge of handling NEST are the affordances and external conditions that allow or pressure developers of newly emerging technologies, civil society actors and other stakeholders such as government agencies to consider NEST and the associated emerging societal issues as a topic for extended deliberation and negotiation.

At this moment, the realization of public-sphere type interactions in actual spaces is not included in the (institutionalized) tasks and mandates of technology developers and civil society actors. Competences need to be developed, both on the side of technology developers as well as civil society actors, if we are to have these types of interactions. The empirical study shows that capacity-building that facilitates civil society actors in taking up the new role of a dialogue partner remains on the agenda of policymakers. Although this is important, it remains a somewhat limited approach. Technology developers must also deal with a new situation; engaging in dialogue with civil society actors at an early stage also requires developing the relevant competences. These include willingness as well as the capacity to accept discussion of innovation trajectories, rather than seeing them as given (‘take it or leave it’). Established mandates and the daily routines of technology developers currently put constraints on these types of interaction. In addition, intellectual property and confidentiality of competitive information also introduces obstacles to have public-sphere type interactions on NEST.

Choices that influence the development and eventual embedding of newly emerging technology in society are not made at one particular point in time or place. On the contrary, decisions are taken throughout the innovation trajectory, and in different contexts, such as laboratories, firms and government agencies. To be able to make informed decisions based on the input from interactions with civil society actors, these outcomes ideally need to be visible and disseminated in the public sphere. In this way, actors who did not participate in the actual space for interaction can consider the outcomes in their decision-making processes. The empirical study shows that actual interactions take place in more or less protected spaces, and that the outcomes were not immediately visible and

disseminated at the collective level, that is, the public sphere. In our society, special efforts are required in order to aggregate, share and otherwise disseminate information about what is occurring in the protected spaces for interaction, ensuring it becomes part of the public sphere – through websites, for example, as occurred with the outcomes of the collaboration between DuPont and EDF and the NanoCap project. However, moving from interactions in a protected space to the collective level introduces the issues of which and whose stakes and concerns are aggregated in an outcome, and how and which outcomes are disseminated. The Committee for the Societal Dialogue, for example, managed to create all kinds of spaces for interaction by funding different kinds of projects. However, in developing their monitoring and evaluation criteria for the projects, the Committee was primarily interested in outreach (e.g. how many people were reached; how much media attention did the project receive) and less in the content. This was a missed opportunity, as issues and concerns that were articulated in the individual projects did not become visible in public reports, or at best only a fraction of the issues were reported.

Realizing articulation processes in relation to newly emerging technologies is not restricted to protected spaces. Protests and online petitions by non-governmental organizations, for example, can invite other groups of actors to respond, and may force them to take a position in relation to these actions. This dynamic was visible when DuPont and EDF launched their risk framework. In response to it, an international coalition of more than twenty CSOs published an open letter in which they rejected the partnership as well as the risk framework as soft governance proposal. In fact, such friction and tensions that can emerge when outcomes become publicly available can provide insight into what is at stake and for whom, not only with regard to the technology, but also with regard to what are seen as legitimate roles and responsibilities of industry and CSOs.

The current discourse and experimentation with upstream public engagement can be seen as a bottom up experimentation with what could become a public sphere that enables deliberation on newly emerging nanotechnology as a matter of common concern. The analysis of interaction initiatives undertaken in this thesis demonstrates how more productive deliberation can occur and how sensitivity to the relevant issues can be enhanced. The cases studied in this thesis were one-off affairs in the sense that the projects did not receive follow up. However, other opportunities remain in our society – not least because of new innovation policies – for newly emerging science and technology to become a topic for deliberation, with civil society actors as new dialogue partners. The challenge we are facing is not that of how to have more civil society actors involved in research and innovation trajectories, but how their involvement can improve the identification and articulation of

emerging indeterminate situations. Determining who should be involved and what types of interaction are productive depends on the diagnosis of indeterminacy and remains part of what has to be discovered and articulated. This thesis examines how to take up this challenge – which plays out at different levels – and how to do so in a more reflexive way.

Samenvatting

Nieuw opkomende nanotechnologieën, gebaseerd op het observeren en manipuleren op de nano-schaal, zijn een uitdaging voor de maatschappij. Er zijn allerlei beloftes, bijvoorbeeld beter voedsel of goedkopere gezondheidszorg, maar ook enige bezorgdheid over schadelijke effecten van nano-materialen. Tegelijkertijd is het onzeker welke vorm de nieuw opkomende nanotechnologieën uiteindelijk zullen krijgen. Dit proefschrift onderzoekt hoe *civil society actors* (burgers en non-gouvernementele organisaties, NGOs) op een productieve manier kunnen participeren als nieuwe dialoogpartner in de ontwikkeling en maatschappelijke inbedding van nanotechnologie.

Voor nanotechnologie wordt momenteel een proactief innovatiebeleid gevoerd. Al in een vroeg stadium van de ontwikkeling, wanneer er nog veel onzekerheden en onvoorspelbaarheden zijn, wordt geprobeerd te anticiperen op mogelijke maatschappelijke kwesties met als doel ermee rekening te houden in verdere besluitvormingsprocessen. Een van de manieren is het vroegtijdig betrekken van civil society actors als nieuwe dialoogpartner. Van hen wordt nu verwacht dat zij samen met wetenschappers, industriëlen en beleidsmakers zullen bijdragen aan een verantwoorde ontwikkeling van nanotechnologie waarbij tijdig ingegaan wordt op maatschappelijke bezorgdheden, wensen en behoeften.

Het betrekken van civil society actors als nieuwe dialoogpartner biedt in principe mogelijkheden om beter inzicht te krijgen in wat nanotechnologie kan gaan betekenen. Zij kunnen immers nieuwe perspectieven, ervaringen en dilemma's inbrengen. Hoe productieve interacties over nanotechnologie met civil society actors te realiseren, is echter nog onduidelijk. Het betreft een nieuwe situatie waar nog weinig routines en best practices voor ontwikkeld zijn. Dit proefschrift pakt deze uitdaging op door te laten zien wat er momenteel gebeurt in ruimtes voor interactie met civil society actors, en hoe dit verbeterd kan worden.

In het vormgeven van ruimtes voor interactie wordt momenteel onvoldoende rekening gehouden met het open einde karakter van nieuw opkomende technologieën, met name de combinatie van beloftes en onzekerheden over uitkomsten. Het proefschrift analyseert enkele veelbelovende ruimtes waarin interactie heeft plaatsgevonden, en beoogt ontwerp voorwaarden te ontwikkelen op basis van dit empirisch onderzoek, gecombineerd met inzichten uit de politieke filosofie van Dewey en Arendt, voor ruimtes waarin goede interacties kunnen plaats vinden. Deze voorwaarden hebben niet alleen betrekking op concrete ruimtes voor interactie, maar ook op de bredere context waarin

de interacties zich afspelen, zoals de organisaties waar verschillende actoren werkzaam zijn, en de instituties van wetenschap en technologie in onze samenleving.

In interactie initiatieven tussen nanotechnologie-ontwikkelaars en civil society actors ligt de nadruk doorgaans op het overdragen van informatie. Nanotechnologie-ontwikkelaars krijgen de rol toebedeeld om uitleg te geven over wat nanotechnologie is. Van civil society actors wordt verwacht dat zij thema's, bezorgdheden en behoeften uit de maatschappij kunnen herkennen en verwoorden, zodat nanotechnologie-ontwikkelaars deze kunnen betrekken in hun besluitvormingsprocessen.

De vooronderstelling is dat zowel nanotechnologie als maatschappelijke zorgen en behoeften gegeven zijn. Maar nieuw opkomende technologieën worden juist gekenmerkt door open beloftes en onzekerheden. Dit betekent dat in een vroeg stadium van de technologieontwikkeling, maatschappelijke kwesties niet zomaar beschikbaar zijn voor bespreking en dus ook niet verwoord kunnen worden door civil society actors. Bezorgdheden, wensen en behoeften ontstaan in relatie tot nieuwe mogelijkheden en keuzes die gemaakt worden gedurende de technologieontwikkeling, en moeten als zodanig continu onderzocht en gearticuleerd worden gedurende een innovatietraject. Inzicht krijgen in wat nieuw opkomende technologieën kunnen betekenen is dan idealiter ook een gezamenlijke onderneming voor alle betrokkenen.

Om meer productief te kunnen anticiperen op mogelijke maatschappelijke kwesties dient de taakverdeling tussen technologie-ontwikkelaars enerzijds en civil society actors anderzijds aangepast te worden. Ook wetenschappers, industriëlen en overheden moeten hun activiteiten, overwegingen en dilemma's delen, zodat in interactie met elkaar en in relatie tot concrete omstandigheden onderzocht kan worden welke mogelijke problematische aspecten zich aandienen. Het realiseren van dergelijke interacties vergt nieuwe rollen en verantwoordelijkheden van alle betrokkenen.

In dit proefschrift betoog ik dat een werkende publieke sfeer een achtergrondvoorwaarde is om meer productieve interactie over nanotechnologie te realiseren. Een publieke sfeer, de openbare ruimte in onze samenleving, wordt ondersteund door een diffuse infrastructuur die de mogelijkheid geeft aan mensen om direct of indirect, via media als kranten, TV, websites en recentelijk ook via Twitter en blogspots, met elkaar in discussie te gaan en te blijven over kwesties die het samenleven betreffen. In een vitale publieke sfeer kan continue onderzocht en gearticuleerd worden wat er speelt, en welke kwesties aandacht verdienen.

Dit ideaalbeeld van bespreken van nieuw opkomende technologieën als gemeenschappelijke kwestie in de publieke sfeer is niet zonder meer te realiseren. Een groot deel van de samenleving is niet op de hoogte van deze ontwikkelingen en de producten ervan spelen nog niet in het dagelijks leven. Er is dus nog weinig of geen ervaring waaruit mensen kunnen putten. Bovendien zijn de uiteindelijke vorm en effecten van nieuw opkomende technologieën nog onzeker. Sterker nog, de dimensies waarlangs ze beoordeeld kunnen worden, zijn nog onduidelijk (ze zijn ongedetermineerd). Om nieuw opkomende technologieën op een productieve manier te kunnen bespreken, en inzicht te krijgen in wat maatschappelijke kwesties zijn en voor wie, is daarom extra werk nodig.

Het doel van dit proefschrift is te onderzoeken hoe articulatie- en leerprocessen in de publieke sfeer, gerealiseerd kunnen worden in relatie tot nieuw opkomende technologieën, nu met civil society actors als nieuwe dialoogpartner.

Deze thematiek wordt op twee complementaire manieren onderzocht. In de eerste plaats empirisch, door interessante cases te analyseren waar actoren experimenteerden met nieuwe taakverdelingen. In de tweede plaats door ideeën te ontwikkelen, onder andere gebruikmakend van de politieke filosofie van Dewey en van Arendt, over goede ruimtes voor interactie, en de bredere context ervan. Deze ideeën worden door mij geoperationaliseerd om de empirische cases te evalueren.

Door deze complementaire aanpak kunnen drie vragen behandeld worden. Wat kunnen productieve publieke sfeer type interacties zijn om de ontwikkeling van nanotechnologie te bespreken? Wat zijn goede ruimtes waar dit type interacties in plaats kan vinden? En een ontwerpvraag: hoe dergelijke ruimtes te ontwerpen en te orkestreren?

In het empirische gedeelte van dit proefschrift zijn verschillende type ruimtes voor interactie onderzocht waar nieuwe taakverdelingen tussen nanotechnologieontwikkelaars en civil society actors aan de orde waren. Omdat er geen of weinig ervaring is met wat voorwaarden zijn voor goede ruimtes waar publieke sfeer type interacties kunnen plaatsvinden, zijn de cases zodanig geselecteerd dat een variëteit aan ruimtes onderzocht kon worden. Hiermee kan inzicht verkregen worden in wat werkt, en wat niet. Niet zozeer in termen van de doelstellingen van de projecten zelf, maar in termen van publieke-sfeer type interacties, de interacties die van belang zijn om ongedetermineerd te articuleren.

Het eerste type ruimte wordt gevormd door zogenaamde co-constructieprojecten. Waar industriëlen en civil society actors doorgaans in relatief gescheiden werelden werken, zijn er de laatste jaren meerdere initiatieven geweest om gezamenlijk producten te ontwikkelen. De eerste ruimte voor interactie die bestudeerd wordt is de driejarige samenwerking tussen DuPont en milieuorganisatie Environmental Defense Fund (EDF). DuPont en EDF slaagden erin om samen een raamwerk voor risicobeoordeling te ontwikkelen.

Een tweede type ruimte is zichtbaar in capaciteitsontwikkelingprogramma's voor NGO's. De Europese Commissie stelt momenteel middelen ter beschikking voor NGO's om hun nieuwe rol en verantwoordelijkheid als dialoogpartner te ontwikkelen. De casus die hierbij bestudeerd wordt is een project gericht op capaciteitsontwikkeling en positiebepaling voor milieugroepen en vakbonden NanoCap. Concrete interacties met nanotechnologie ontwikkelaars waren onderdeel van het project.

Grootschalige nationale dialogen met burgers worden al sinds de jaren '80 van de vorige eeuw georganiseerd als manier om nieuw opkomende technologieën onderwerp van gesprek te maken. Wat nieuw is, is dat bij nanotechnologie geprobeerd is nationale dialogen in een vroegtijdig stadium van de ontwikkeling te organiseren, wanneer er nog veel onzekerheden en onvoorspelbaarheden zijn over wat de technologie kan gaan opleveren. De derde ruimte voor interactie die besproken wordt, is de Nederlandse Maatschappelijke Dialoog Nanotechnologie, welke plaatsvond tussen 2009 en 2011. De Maatschappelijke Dialoog was onderdeel van het Nederlandse 'Actieplan Nanotechnologie' en had als doel met geïnteresseerde burgers en stakeholders bredere ethische en maatschappelijke aspecten (dat wil zeggen, meer dan alleen risico's) te identificeren die momenteel onvoldoende opgepakt worden door instanties. Een onafhankelijke Commissie ontwikkelde concrete richtlijnen hoe de dialoog te voeren, subsidieerde projectvoorstellen, en had als taak de uitkomsten van de dialoog weer te geven in publiek toegankelijke rapportages.

CTA+ workshops georganiseerd door sociaal wetenschappers binnen deze Maatschappelijke Dialoog Nanotechnologie is het vierde type ruimte dat aan bod komt in dit proefschrift. Deze workshops waren op zo'n manier ontworpen dat onduidelijkheden met betrekking tot veranderende maatschappelijke normen, waarden en verantwoordelijkheden als gevolg van concrete nanotechnologie-ontwikkelingen, in dit geval met betrekking tot het realiseren van gezondheidszorg-op-afstand, onderwerp van gesprek konden zijn. Vergeleken met eerdere opkomende technologieën zoals kernenergie en biotechnologie, wordt bij nanotechnologie uitdrukkelijk anticipatie op mogelijke maatschappelijke kwesties gezien als ook een verantwoordelijkheid van technologieontwikkelaars.

Deze situatie heeft er toe bijgedragen dat technologie-ontwikkelaars hun deelname in dergelijke ruimtes voor interactie als legitiem zijn gaan beschouwen.

Wat zijn de bevindingen van het empirisch onderzoek naar deze vier verschillende casussen? Goede ruimtes voor publieke sfeer type interacties kunnen georganiseerd worden. Een van de voorwaarden hiervoor is de aanwezigheid van een herkenbare ongedetermineerde situatie ('er moet iets op het spel staan voor deelnemers') en de deelname van een adequate heterogeniteit aan betrokkenen. Dat zijn zij die, op verschillende manieren, onderdeel zijn van de ongedetermineerde situatie.
Zowel de samenwerking tussen DuPont en EDF als het NanoCap programma werden opgericht omdat betrokkenen bezorgd waren over een mogelijke ongedetermineerde situatie met betrekking tot risico's van gefabriceerde nanomaterialen voor mens en milieu. Hoewel de aanleiding hetzelfde was, positioneerde de NGO's zich verschillend. Milieuorganisatie EDF positioneerde zichzelf nadrukkelijk als onderdeel van de ongedetermineerde situatie, en als dialoogpartner voor industrie om deze situatie tijdens innovatietrajecten gezamenlijk verder te onderzoeken. Milieugroepen in NanoCap positioneerden zich voornamelijk als waakhond, en wilde geen onderdeel zijn van de concrete innovatietrajecten zelf.

Ongedetermineerde situaties rond nieuw opkomende technologieën zijn niet zonder meer herkenbaar voor betrokkenen. Daarom is er een rol voor intermediairen, zoals wetenschapscommunicatoren en analisten. Zij kunnen een functie vervullen in het articuleren van ongedetermineerde situaties, tot en met het organiseren van ruimtes voor interactie om de situatie verder te onderzoeken en problemen te articuleren. Intermediairen hebben geen vaste positie ten opzichte van de nieuw opkomende technologie. Daardoor kunnen zij breed verkennen wat er aan de hand is en welke perspectieven er spelen om op die basis te articuleren wat mogelijke knelpunten gaan worden.

Het empirisch onderzoek laat zien dat nanotechnologie ontwikkelaars en civil society actors zich tijdens interacties snel focussen op risico kwesties. Hierdoor blijven andere maatschappelijke kwesties, zoals de verschuiving van maatschappelijke waarden en normen, op de achtergrond. In zowel het co-constructieproject, als in Nanocap articuleerden de deelnemers nadrukkelijk dat het niet hun taak was om bredere maatschappelijke kwesties te onderzoeken. Ook het merendeel van de projecten tijdens de Maatschappelijke Dialoog was gericht op het bespreken van risico's van nanotechnologie. Dit is niet zo verwonderlijk omdat er in onze samenleving inmiddels een cultureel repertoire van overwegingen aanwezig is om risico's te bespreken. Voor bredere ethische en

maatschappelijke aspecten is er geen duidelijk repertoire aanwezig waar actoren uit kunnen putten. Als onderdeel van de Maatschappelijke Dialoog werden er wel projecten georganiseerd waarin nanotechnologie-ontwikkelaars en civil society actors bredere ethische en maatschappelijke aspecten onderzochten en problematische kwesties articuleerden. Uit deze projecten bleek dat externe input, zoals vignetten en scenario's, een manier is om bredere ethische en maatschappelijke aspecten onderwerp van gesprek te maken. Vignetten en scenario's kunnen via een narratief laten zien hoe nieuwe, op nanotechnologie gebaseerde producten, huidige normen, waarden en verantwoordelijkheden beïnvloeden en mogelijk veranderen. Hierdoor worden deelnemers in de ruimte voor interactie in staat gesteld te verbeelden wat er voor hen op het spel staat, en problematische aspecten te benoemen.

Verder laat het empirisch onderzoek zien dat publieke sfeer type interacties tussen nanotechnologie ontwikkelaars en civil society actors niet zomaar tot stand komen, maar dat vormen van bemiddeling, bijvoorbeeld via externe input, een moderator of het werken aan een gezamenlijk product, van belang zijn. Zowel in het co-constructieproject als in het NanoCap project hadden de deelnemers als taak een gezamenlijk product te ontwikkelen. Dit zorgde ervoor dat zij het eens moesten worden over wat de problemen zijn, wie er bij betrokken zijn, en wat er gedaan moet worden. Dit leidde ertoe dat deelnemers elkaar gingen bevragen, en dat ze hun visies en overwegingen deelden. In de CTA+ workshops werden publieke sfeer type interacties, zoals ontwikkeld in het theoretisch deel van het proefschrift, op twee manieren actief gestimuleerd. Als input voor gerichte interactie werden op reële ontwikkelingen gebaseerde scenario's aangeboden. In de tweede plaats begeleidde een moderator de interacties op basis van een interactieprotocol. De input in de vorm van empirisch geïnformeerde scenario's bleek een goede manier te zijn voor actoren om te leren hoe zij betrokken zijn bij opkomende ongedetermineerde situaties, en wat er voor hen op het spel staat.

Een adequate invulling van ruimtes voor interactie is nodig om publieke sfeer type interacties te stimuleren, maar de context waarin deze zich afspelen, zoals de instituties waar verschillende type actoren werkzaam zijn, moet ook geschikt zijn voor het realiseren van dergelijke interacties en het oppakken van de uitkomsten ervan.

Op dit moment behoort het tot stand brengen van publieke sfeer type interacties in concrete ruimtes niet tot de verantwoordelijkheden en routines van technologie-ontwikkelaars en civil society actors. Om publieke sfeer type interacties te realiseren, moeten competenties ontwikkeld worden. Het

empirisch onderzoek laat zien dat beleidsmakers en intermediairs op dit moment vooral gericht zijn op het ontwikkelen van competenties bij civil society actors. Dit is belangrijk, maar ook eenzijdig. Ook voor technologie-ontwikkelaars is het bespreken van nieuw opkomende technologieën met civil society actors een nieuwe situatie. Daarvoor dienen ook zij competenties te ontwikkelen, alsmede de mogelijkheid te hebben hun activiteiten en overwegingen ter discussie te stellen. Historisch gegroeide dagelijkse verantwoordelijkheden en mandaten van technologie-ontwikkelaars maken dat op dit moment niet gemakkelijk. Er spelen ook kwesties van vertrouwelijkheid en intellectueel eigendom.

Keuzes voor hoe een technologie verder te ontwikkelen worden niet op één plek, en niet op één tijdstip gemaakt. Integendeel. Gedurende een innovatietraject, en in verschillende contexten, zoals bij overheden en in laboratoria van universiteiten en bedrijven worden voortdurend beslissingen genomen. Om op basis van interactie met civil society actors meer geïnformeerde keuzes te maken, dienen uitkomsten, idealiter, zichtbaar en gedissemineerd te worden in de publieke sfeer. Op deze manier kunnen andere actoren, die niet aanwezig waren, hier kennis van nemen, en inzichten een rol laten spelen in hun onderhandelings-en besluitvormingsprocessen. Het empirisch onderzoek heeft laten zien dat interacties plaatsvinden in beschermde ruimtes, en dat uitkomsten niet zonder meer zichtbaar en gedissemineerd worden. Hiertoe zijn in onze samenleving extra inspanningen nodig. De uitkomsten van het co-constructieproject en Nanocap werden bijvoorbeeld openbaar via websites. Een kwestie die speelt is welke en wiens bezorgdheden en belangen samen worden genomen tot een uitkomst, en hoe en welke uitkomsten vervolgens zichtbaar en gedissemineerd worden. De Commissie van de Maatschappelijke Dialoog slaagde er bijvoorbeeld in om allerlei ruimtes voor interactie te creëren. In de evaluatie van de projecten bleek de Commissie echter voornamelijk geïnteresseerd te zijn in het creëren van zichtbaarheid van nanotechnologie in de maatschappij en het bereiken van zoveel mogelijk mensen, en minder in de inhoud. Dit is een gemiste kans. Kwesties die gearticuleerd werden in de individuele projecten, werden hierdoor niet zichtbaar in de publieke rapportages.

Het realiseren van articulatieprocessen in relatie tot nieuw opkomende technologieën beperkt zich echter niet tot beschermde ruimtes voor interactie. Protesten en online petities van NGO's bijvoorbeeld nodigen andere actoren uit tot reageren en dwingt hen een positie in te nemen ten opzichte van deze acties. Deze dynamiek werd bijvoorbeeld in gang gezet toen DuPont en EDF hun risico-raamwerk openbaar maakten. Als reactie schreef een coalitie van NGO's een open brief waarin zij zowel het risico-raamwerk, als samenwerkingen tussen industrie en NGO's afkeurden. Juist

dergelijke fricties, die bijvoorbeeld kunnen ontstaan als uitkomsten openbaar worden, kunnen inzicht verschaffen in wat er speelt. Niet alleen met betrekking tot de technologie, maar ook met betrekking tot welke rollen en verantwoordelijkheden als legitiem worden beschouwd.

De huidige vroegtijdige interactie-initiatieven kunnen gezien worden als een bottom-up experimenteren met wat een publieke sfeer zou kunnen zijn die het bespreken van de ontwikkeling van nanotechnologie als een gemeenschappelijk kwestie mogelijk maakt. Het analyseren van interactie-initiatieven, zoals in dit proefschrift is gedaan, heeft laten zien hoe dit op een meer productieve manier te doen en hoe de gevoeligheid voor kwesties die spelen te vergroten. De onderzochte interactie-initiatieven waren eenmalige activiteiten in de zin dat ze geen vervolg hebben gekregen. In onze samenleving zijn er echter, mede door het nieuwe innovatiebeleid, nog steeds mogelijkheden aanwezig om nieuw opkomende technologieën onderwerp van gesprek te maken, met civil society actors als nieuwe dialoogpartner. De uitdaging waar we voor staan, is niet dát civil society actors gaan participeren als nieuwe dialoogpartner, maar hoe ongedetermineerde situaties onderzocht en gearticuleerd kunnen worden. Het dynamische karakter van nieuw opkomende technologieën zorgt er voor dat ongedetermineerde situaties en betrokkenen niet gegeven zijn, maar continue opnieuw geïdentificeerd moeten worden. Dit proefschrift heeft onderzocht hoe deze uitdaging, die op meerdere niveaus speelt, aan te gaan, en op een meer reflexieve manier.

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Biography

Lotte Krabbenborg is a graduate of the University of Humanistic Studies in Utrecht. Parallel to her study, she also gained a grade one teaching qualification in humanist ethical and worldview education, and followed extracurricular course units in philosophy. Her research placement at the Institute for Gender Studies at Radboud University Nijmegen, and her thesis ('De onthullende tussenruimte: engagement in het denken van Simone de Beauvoir en Hannah Arendt'), sparked her interest in following a PhD programme. After graduation she became a PhD candidate at the University of Groningen. In addition to her PhD research, she developed a course unit on Technology Assessment for the Honours College of the University of Groningen, held the position of Chair of the Groningen Association for PhD students, was project leader of a Nanopodium project ('Gezamenlijk leren via lab-on-a-chip technology en body-area-netwerken'), and was involved in the EU consortium PERARES. She is continuing her research on the role of civil society actors in innovation trajectories as a postdoctoral researcher at Radboud University Nijmegen, working on patient involvement in the emerging field of personalized genomics (IQ Healthcare), and the involvement of NGOs in the transition to a biobased economy (ISIS).